THE BOOK
of
KNOWLEDGE

Kathryn Crossley
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Denver - Colo

THE EDICT OF WILLIAM THE TESTY

William the Testy, second governor of New Amsterdam, issued an edict prohibiting smoking, which provoked warm indignation, and an army of insurgents, well supplied with pipes, tobacco and determination, seated themselves before the governor's house and began to smoke. Governor Kieft came forth in a fury and asked what they meant by this "outrageous fumigation." They did not reply, but puffed and puffed in stolid silence. It is related that the governor came to terms.

The Book *of* Knowledge

The Children's Encyclopædia

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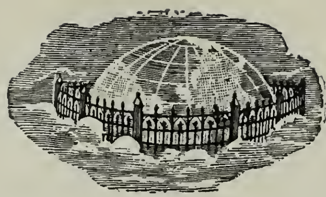
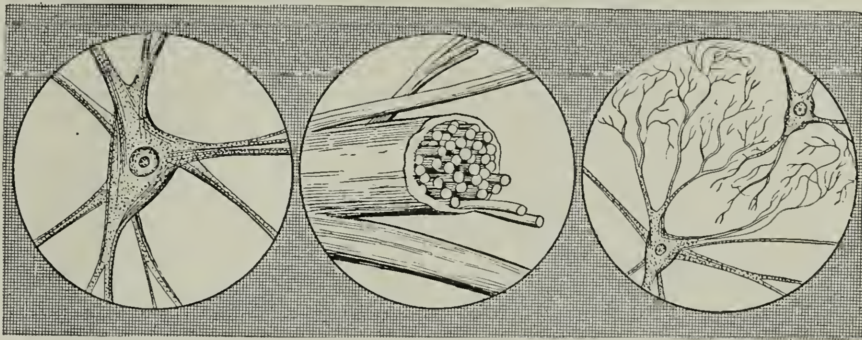


CONTENTS OF THIS VOLUME

This is a short guide only to the principal contents of this volume. It is not possible to give the titles of all the Poems and Rhymes, Legends, Problems, color pages, questions in the Wonder Book, and many other things that come into the volume; but in all cases the pages where these parts of our book begin are given. The full list of these things comes into the big index to the whole work.



In the left-hand picture, showing a nerve-cell magnified, we see the nucleus and nerve-fibres. These fibres may intertwine with those of another cell, as seen in the right-hand picture, but never unite. The middle picture shows a bundle of nerve-fibres in their sheath, with smaller bundles branching off.

A FOREST OF NERVES WITHIN US

CONTINUED FROM 3418

IF we feel gently at the back of the elbow, rather towards the inner side, we find a thing that feels like a thick, smooth cord, and if we squeeze it or knock it accidentally, we discover that it is what we call the "funny-bone." It is a nerve, and therefore belongs to the most marvelous of all marvelous things. If we take a nerve and look at it, we find that it is just a cord made up of tiny threads which are called fibres. It is these fibres that are the real nerves. The thick cord is simply a bundle of them traveling part of their journey in each other's company.

A nerve-fibre is a thing which is probably not to be found anywhere in the vegetable world, but these things begin to appear quite low in the scale of the animal world, and their importance and number become greater and greater as we ascend. There is no part of the body that has not nerves supplied to it, and there is no part of the body that does not suffer in some way or another if the nerves running to it be damaged or cut.

When we examine a nerve-fibre, we find that it is a very long thread, usually surrounded by a sheath or coat which contains a quantity of a special kind of fat. There are a great many points of view from which we can think of a nerve as if it were an electrical wire, and the sheath may be regarded as what is called an insulator—a thing to prevent the current that flows in the nerve from leaking outside it. It is very interesting to take a modern electrical cable such as men lay in the Atlantic Ocean, and to cut it across and see what it looks like; and then to take a good-sized nerve and cut it across and magnify it so as to compare it with the cut cable. We see at once that men have found it useful to make their cables on exactly the same principle as nerves are made, with bundles of fibres big and little, all carefully insulated from one another. Of course, the nerve is a million times more wonderful, but the general principles of the way in which the nerve-fibres are packed together, and the way in which each is sheathed so as to prevent any leakage of its precious current, are really just the same as in the case of the cable.

When we excite our "funny-bone," as we call it, by hitting it, we feel a tingling in our fingers. We have excited the fibres which carry feeling along the nerve from the fingers to the

brain. In other cases when we excite a nerve, muscles will twitch. We have excited fibres which carry orders along the nerve from the brain to those muscles. This shows that nerves carry something, and may do so in either direction, from the brain, or to the brain. The nerve-fibre is therefore a conductor. It is just like the wires in the cable. They do not make messages, but they carry them. What runs along the wire will run in either direction. It is probable that any particular nerve-fibre carries what it carries only in one direction.

THE LIVING NERVE THAT CARRIES MESSAGES THROUGH OUR BODIES

The wire carries an electrical current. As long as the wire is not broken, and is properly insulated, the current will run. The wire is not alive, and, though we by no means understand what happens in it, yet it has not about it the mystery which we find when we look at a nerve.

For the noteworthy thing about a nerve is that it will only carry what it carries *when it is alive.* We can remove a piece of nerve from an animal that has been killed, and can study it in various ways. If we keep it moist with water containing a little salt, and if we keep it warm enough, it will live for quite a long time, and as long as it is alive things that disturb one end of it will send something through it. But when it dies it will no more carry messages than a piece of string will. What makes the difference between life and death in the nerve we cannot understand until some day, perhaps, we shall learn what life is. We can see no change under the microscope to account for this difference, for we have to kill the nerve in order to look at it under the microscope.

THE MYSTERY OF THE NERVE-CURRENT THAT NO MAN CAN UNDERSTAND

The thing that runs along the nerve we call a nerve-current, or a nervous current. Current simply means something that runs, and that is really almost all we know about it. It is not the same as anything else in the world; it directly depends upon the life of the nerve, as we have seen. It is not electricity. Curious changes are produced in a nerve when a nerve-current runs along it, and among these changes is the production of electrical currents of various kinds, which have been long and carefully studied. These show that an electrical change has been produced in the nerve when a nerve-current runs along it, and the study of these electrical changes may help us to understand the nerve, but it is a very great and serious mistake to suppose that the nerve-current is electrical.

Electrical currents in a cable or anywhere else move at a wholly different speed from that of a nerve-current. Nerve-currents have been measured again and again, and they travel at rates which, compared with the movement of electricity, are very slow. The rate of a nerve-current seems to be about the same as the rate at which a baseball can be thrown. An electrical current is hundreds of thousands of times faster.

Nothing seems to be used up in a nerve when it conveys a current, any more than in the case of a telegraph wire. So we cannot make a nerve tired. As long as it remains alive, it will go on sending currents as often as we choose to start them in it. The case of a nerve-cell is very different.

THE NERVE-CELLS UPON WHICH ALL OUR FEELINGS DEPEND

We have only been talking about conductors, remember. We have, so to speak, taken a piece of one of these conductors, just as if one took a piece out of a cable, and we have studied that. But if we wished really to understand telegraphy, we should have to study what is at the ends of the cable, and that applies to the case of the nerve too. We found that we could excite a nerve by hitting it against something, as when we hit our funny-bone, or by pinching it; and there are dozens of other ways, as, for instance, by giving one end of it an electrical shock, dropping chemicals on it, and so on. But, of course, that is not what happens naturally in our bodies. We must find where the nerve comes from.

Every nerve-fibre grows out of a nerve-cell. It is part of that cell. It is only the servant of the cell, carrying orders from it or messages to it. The real thing, where the greatest mystery lies, and upon which everything depends, is the nerve-cell. When we study the development of the body, we find that every nerve grows out of the cell that it belongs to; we find also that, if a

nerve be cut across, the part which is next the cell is unhurt, but the part which is separated from the cell invariably dies. We find also that, if a nerve-cell is destroyed or poisoned, the nerve-fibre running out from it invariably dies, and if the nerve-cell has been actually killed, that nerve-fibre can never recover. So *these* "cable wires" are not merely alive, but they are created by living cells, of which, indeed, they are living parts. That is one of the marvels which make a cable a very simple thing indeed compared with a nerve.

THE DENSE FOREST OF NERVES THAT GROWS UP IN OUR BODY

A nerve-cell may have only one fibre coming from it, or it may have several. Very frequently, for certain purposes, we find nerve-cells which have one fibre coming out from each end of them. The fibres from any nerve-cell are very often found going to meet the fibres from another nerve-cell. Suppose, then, we can trace a nerve-fibre from a cell somewhere in the brain, for instance, and we find that it meets another fibre from another cell, perhaps at some other place in the brain. It is interesting to know whether the two fibres run into each other. Careful study shows that the fibres never run into each other. At their extreme ends they break up into tiny little fingers, so to speak, and the fingers of the two fibres will interlace; but they never run into each other. If we study parts of the brain where many nerve-cells and nerve-fibres exist together, we find, as someone has said, that it is very like a dense forest. Their leaves and branches intermingle with each other in the closest possible way; but they never actually join. We shall never find a leaf that belongs to two trees.

WHAT THE SIMPLE BRAIN OF A BEE OR WASP IS LIKE

All this is very important, because it teaches us that just as a gas is made of atoms, just as the body as a whole is made of cells, so the nervous system is made up of true units which are also cells, and though these cells are of a very peculiar kind and produce fibres which may run right away from the body of the cell for inches or even feet, yet each cell remains a true unit.

In the very lowest animals that have nerve-cells and nerves, the number is very few, and the arrangement very simple. They are usually arranged merely to carry feeling from the outside of the animal to its inside. But as we ascend the scale, nerve-cells and nerves become more numerous, and often, for convenience, numbers of them are bunched together into little balls, each of which is a nervous centre, perhaps somewhat like a telephone exchange.

When these collections of nerve-cells become very large, they make a thing that we can only call a brain, and such are the brains of a bee or a wasp, for instance. The whole arrangement of nerve-cells and nerve-fibres is called a nervous system.

When the first backbones came into existence, there also came into existence a number of new nerve-cells and nerve-fibres, and the central home of this new nervous system was inside the backbone. The old nervous system, such as the insects have, remained, and communications were established between it and the new nervous system.

HOW THE BRAIN SENDS AND RECEIVES MESSAGES THROUGH THE NERVES

In all animals that have backbones, both these nervous systems are found, and we may say very roughly that while the old one, which is really similar to those found in the days before backbones, looks after the interior life of the body, it is the new nervous system that is the instrument of the mind. At its upper end, the long tube inside the backbone opens out, as we know, into the hollow skull; and in the same way the nervous matter which is found in the backbone, and which we call the spinal cord, becomes enlarged, and forms what we call the brain.

The brain and the spinal cord form what is often called the central nervous system. Through holes in the skull and through openings in the backbone run nerves which connect the central nervous system with every part of the body, and every part of the body with the central nervous system.

It seems quite clear that, whether we take the group of cells that forms a mere hair or any other of the least important parts of the body, we always find that it has a perfect double connection with the central nervous system. The brain, or the spinal cord, or both,

can send to it messages upon which its life depends, and it, on the other hand, can send messages to them.

When we come to study the central nervous system, we find it so arranged by means of this double connection that every tiniest part of the body is really in true communication, when necessary, with every other part of the body without exception. It is this amazing fact that helps to explain how the body becomes a whole in spite of the infinite variety and number of its parts. In no city on earth, however rich in telephones, and speaking-tubes, and telegraphs, and post-offices and messenger-boys, is there any arrangement a thousandth part as wonderful as the arrangement by which the nervous system connects all the parts of the city of Mansoul, as John Bunyan called it.

THE FOREST OF NERVES RUNNING TO AND FROM EVERY PART OF OUR BODY

We have already learned what is necessary regarding nerves. If we simply understand that the lining of the heart, the wall of a vein, the base of a nail, every muscle-fiber, and all other parts of the body are doubly connected by nerves with the central nervous system, we do not need to inquire how and where these nerves run; though, of course, the doctor has to spend long months and years in studying this. We must devote ourselves now to the central nervous system, and especially to the brain.

We saw when we were studying alcohol that the central nervous system consists, in a way, of a number of levels, or layers, and that, as the bodies of animals have become more and more wonderful, new layers have been, so to speak, piled up on the older ones, and each new layer is, so to speak, the master of all the layers below it. It is in this way that we can learn to understand the working of the brain and the spinal cord. The spinal cord is very old, so to say; its business nowadays is to attend to things which are beneath the notice of the brain, as, for instance, the movements of the stomach and that kind of thing. It is a sort of highly trusted and responsible butler in the house of man, and, like other butlers, it not only looks after a great many small matters on its own account, so as not to trouble the master, but it is also the master's means of communication. As a rule, the master gives orders to the butler, and then the butler does the rest.

THE SPINAL CORD THAT ACTS AS BUTLER TO THE BRAIN

On the other hand, tradespeople and so forth, when they have anything to say, do not go to the master, but interview the butler, and he takes the message to the master; so also does the spinal cord. When I close my hand, my brain, which gave the order, did not speak directly to the muscles of my hand. No nerve-fibers run directly from my brain to those muscles, but nerve-fibres do run from my brain to the spinal cord, which is my butler. They give orders to certain nerve-cells in the spinal cord, and from those nerve-cells there *do* run fibres which go to the muscles of my hand. In the same way, when I feel a draught on my skin, the nerves from my skin do not run direct to my brain; they run to cells in the spinal cord, from which communication is made to my brain.

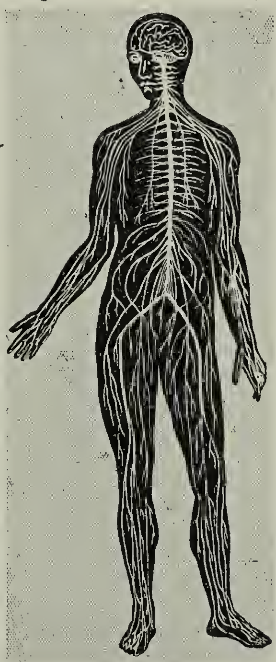
If we cut across the spinal cord, and take a very thin slice of it and stain it with various dyes that will show up the way in which it is made, we find that its structure exactly corresponds with its duties. We find in it fibres and cells. Some of these fibres run to the brain, some from the brain; a great many of them arise from cells in the spinal cord, and run to other parts of the spinal cord, and end there. If, for a moment, we think of the spinal cord as a huge exchange, or place of business, then these fibres are like the private wires that do not come from, or go to, the outer world, but connect one part of the place of business with another.

THE WONDERFUL BOX IN WHICH THE CENTRAL NERVOUS SYSTEM IS KEPT

The usefulness of the spinal cord very largely depends upon the proper working of these beautiful arrangements which keep every part of it informed as to what every other part of it is doing, and enable different parts of it to act in harmony when they so require—which is practically always.

The picture on page 3599 shows us the central nervous system as it appears when taken out of the wonderful box—the skull and backbone—which exists to protect it. We see how, at its upper end,

the spinal cord becomes slightly thicker so as to form what we might call a bulb. That, indeed, is one of the names for this part of the brain. It contains the group of nerve-cells which controls our breathing, and the destruction of which means instant death; also another group of nerve-cells which controls the heart; another group which controls the size of the blood-vessels; another for the acts of sucking and swallowing; another which controls perspiration; and there are probably more. All of these are contained in a little portion of nervous tissue that is just about the size of the end of one's thumb. Above the bulb, things become very complicated. If we had to begin with the study of the grown-up human brain, we should never find the key to it; but if we study the brain as it develops, and if we study the brain in animals, the thing becomes clear. We see quite plainly that what is the lower underneath part of the brain in us, all huddled and squeezed together and completely poked out of sight by something else that has grown over it, is the old brain, the first brain that ever was, so to speak. It contains countless numbers of nerve-cells, arranged in groups with different duties. It is mostly concerned with movements of the body, and in lower animals it is also the place where hearing and seeing and feeling are done. In ourselves we know that some of these senses have become so delicate and wonderful that they require new machinery, and the old centres which were good enough for lower animals are now, in us, only half-way houses towards the new brain.



This picture shows us the wonderful arrangement of nerves in our body, like an elaborate system of telegraph wires. The strong white line is the spinal cord running up to the brain.

Behind the old brain there is a large and important piece of nervous tissue which has a name that really means the little brain. It is called the *cerebellum*. This cerebellum, we have found, gets larger and larger in higher forms of life, but we cannot find that it has anything to do with feeling. We do not hear or see there, it starts no movements, and certainly the will and the powers of thinking do not live there. We find that it is a great instrument for making the body do what we want. The power of balancing the body lives there. A drunken man staggers because he has poisoned his cerebellum. Also the balanced use of the muscles for complicated and delicate actions, like painting or playing the violin, depends upon the control of the cerebellum. It may be thought that these duties are not very exalted, and we may wonder, therefore, why the cerebellum should get bigger as we ascend in the scale of life. But we have already learned that the one thing in the world that we can do is to move things, our bodies and things outside them. Through this power of movement, and only through it, our minds can live and act. So it is very important that our control of movement should be as fine as possible.

It can be proved that in the main line of ascent of life, more and more delicacy and accuracy of movement have always appeared. Part of the history of progress is the replacing of strength by skill. Babies and small children are very clumsy, and as they gradually become more skilful, this means mainly that the cerebellum is developing and getting the powers which it has in grown-up people. In proportion to size of the whole body, the clumsy, stupid animals are those that have a very small cerebellum. The best example of this is one of the stupidest of all the higher animals, the hippopotamus. There are three young hippopotamuses at a zoo, as I am writing, and since it was found how small the brain and the cerebellum of the hippopotamus are, I have been carefully studying these young animals. We can understand that when we catch anything following it with our eyes, and then getting our hands or our mouth to it, we must be using the cerebellum. The hippopotamus has practically no idea of catching at all. It takes a very

long time to see even things that it likes, and if they get into a corner, it is so clumsy that it has not sense enough to use either its feet or its mouth to get them out again.

THE LITTLE BRAIN OF THE GREAT HIPPOPOTAMUS

All this depends upon the smallness of its brain, and especially of its cerebellum. It is reckoned that the brain of the hippopotamus weighs about the same as that of the horse, the weight of whose body is only one-fifth as great. It has been proved over and over again that, in the history of life, success has always gone more and more to brains, to skill as against strength, to mind as against muscle. The hippopotamus is a remarkable instance of an animal that has survived through long ages from the days when brains in general were much smaller than they are now, and the explanation is not to be found in its huge size and strength, but entirely in its mode of life. Its size and strength could never have saved it against better brains.

In the past there have been far bigger and stronger animals than even the hippopotamus, and they have all died out, but the hippopotamus is content to live upon grass and similar plants growing in rivers. It has its nostrils right on the very top of its face, so to speak, and so it can lie with its whole body in the water, and just leave its nostrils above, so that it can breathe. In this way it saves itself by hiding, and still lives on, while stronger and cleverer animals have completely disappeared from the earth.

As we pass upwards in the scale of life, we find that with the growth of the cerebellum, and the development of skill, there comes a time when even the mouth, that dogs and cats and lions and sea-lions are so clever in using, is not a good enough instrument for the clever brain.

THE USE OF THE ARMS WHICH GIVES MAN HIS GREAT POWER

Something even better is required, and so, in the main line of ascent, we find that the animals called lemurs, which are a very humble and ancient kind of monkey, use their hands a little for grasping as well as walking, though they prefer to use their mouths, as anyone can see who feeds them at the Zoo. But when we reach the highest apes, we see that they find and examine, and lift their food with their hands, and then carry it to their mouths. The arms, then, limbs which for countless thousands of years have been used by all sorts of different animals for the same purposes as the hind legs, and for no other, now come to have special purposes of their own, and every finger becomes precious.

Cleverer even than the half-erect apes is man, who, after crawling babyhood is past, frees his fore limbs forever from the duty of locomotion, and learns how to use every one of his fingers separately, as with the typewriter or the piano. There has therefore been an immense development of skill in man—though mere strength has decidedly fallen off—and with it there has necessarily gone a great development of the cerebellum.

This is very interesting, because it helps us not only to understand the brain, but also to understand children. Children belong to a race that lives in the world by its cleverness, and so they like to practise their skill. This is why children love games of skill, and this especially is why, ever since children existed, they have been fond of balls.

WHY IT IS RIGHT THAT BOYS AND GIRLS SHOULD PLAY

Of course, grown-up people do not like to have their windows broken; but still it is right and natural for children to play. What we call play, and stupidly think of as waste of time, is now known by wise people to be part of the necessary education of a child, if it is to reach the best possible for it in health of mind and body. Its play is really an essential part of the work of the child.

It is a great pity that, though any mother cat may be seen teaching her kittens to play, for she knows how important it is for them to become skillful, many children in our land have nowhere to play but the street, no one to teach them good games, no one to care what becomes of them. And yet, if we are not to care about our children, and therefore the future of mankind, many of us would perhaps not care if the whole earth shot up in flame and vanished this very moment. But we hope that before long all children will be able to have happy playtimes.

THE NEXT PART OF THIS IS ON PAGE 3687.

A FABLE TOLD IN VERSE

AMONG the many lesser poets who, while attempting only the treatment of homely subjects, have yet left us poems which, though in form no better than the commonest rhyme, have said something that will be long remembered, Mary Howitt has a place of some eminence. We have already had occasion to speak of Mrs. Howitt and her husband, William Howitt, in reading other poems of theirs printed in this book. They deserve to be remembered for the healthy and elevating character of all they wrote. None of Mary Howitt's verses for young people is better known than "The Spider and the Fly," with which almost every American boy and girl is bound to make acquaintance. Like many another of the poems given in our book, this is a fable in rhyme. The story itself is a very old one, the idea of the spider luring the silly fly to destruction having been a popular illustration of the danger of listening to flattery, long before Mrs. Howitt gave it this versified form.

THE SPIDER AND THE FLY

CONTINUED FROM 3478

"WILL you walk into my parlour?" said the spider to the fly.
"'Tis the prettiest little parlour that ever you did spy;
The way into my parlour is up a winding stair,
And I've many curious things to show when you are there."
"Oh, no, no," said the little fly, "to ask me is in vain,
For who goes up your winding stair can ne'er come down again!"

"I'm sure you must be weary, dear, with soaring up so high;
Will you rest upon my little bed?" said the spider to the fly.
"There are pretty curtains drawn around; the sheets are fine and thin,
And if you like to rest a while, I'll snugly tuck you in!"
"Oh, no, no," said the little fly, "for I've often heard it said,
They never, never wake again, who sleep upon your bed!"

Said the cunning spider to the fly: "Dear friend, what can I do
To prove the warm affection I've always felt for you?
I have within my pantry good store of all that's nice;
I'm sure you're very welcome—will you please to take a slice?"
"Oh, no, no," said the little fly, "kind sir, that cannot be;
I've heard what's in your pantry, and I do not wish to see!"

"Sweet creature!" said the spider, "you're witty and you're wise,
How handsome are your gauzy wings, how brilliant are your eyes!
I've a little looking-glass upon my parlour shelf,
If you'll step in one moment, dear, you shall behold yourself."

"I thank you, gentle sir," she said, "for what your're pleased to say,
And bidding you good-morning now, Ill call another day."

The spider turned him round about, and went into his den,
For well he knew the silly fly would soon come back again;
So he wove a subtle web, in a little corner sly,
And set his table ready, to dine upon the fly.

Then he came out to his door again, and merrily did sing:
"Come hither, hither, pretty fly, with the pearl and silver wing;
Your robes are green and purple—there's a crest upon your head;
Your eyes are like the diamond bright, but mine are dull as lead!"

Alas, alas! how very soon this silly little fly,
Hearing his wily, flattering words, came slowly flitting by;
With buzzing wings she hung aloft, then near and nearer drew,
Thinking only of her brilliant eyes, and green and purple hue—
Thinking only of her crested head—poor, foolish thing! At last
Up jumped the cunning spider, and fiercely held her fast.
He dragged her up his winding stair, into his dismal den,
Within his little parlour—but she ne'er came out again!

And now, dear little children, who may this story read,
To idle, silly, flattering words, I pray you ne'er give heed;
Unto an evil counsellor, close heart and ear and eye,
And take a lesson from this tale of the spider and the fly.

FIDELITY

Among the numberless poems in which the fidelity of the dog is celebrated, this, by William Wordsworth, takes a high place. There are many instances of dogs that have shown as great fidelity to their masters as the shepherd's dog here described, and they are all worthy of the poet's praise.

A BARKING sound the shepherd hears,
A cry as of a dog or fox;
He halts, and searches with his eye
Among the scattered rocks;
And now at distance can discern
A stirring in a brake of fern;
And instantly a dog is seen,
Glancing through that covert green.

The dog is not of mountain breed;
Its motions, too, are wild and shy;
With something, as the shepherd thinks,
Unusual in its cry:
Nor is there anyone in sight
All round, in hollow or on height;
Nor shout, nor whistle strikes his ear:
What is the creature doing here?

It was a cove, a huge recess,
That keeps, till June, December's snow;
A lofty precipice in front,
A silent tarn below;
Far in the bosom of Helvellyn,
Remote from public road or dwelling,
Pathway, or cultivated land;
From trace of human foot or hand.

There, sometimes, doth a leaping fish
Send through the tarn a lonely cheer;
The crags repeat the raven's croak,
In symphony austere;
Thither the rainbow comes, the cloud—
And mists that spread the flying shroud
And sunbeams; and the sounding blast,
That if it could would hurry past;
But that enormous barrier holds it fast.

Not free from boding thoughts, awhile
The shepherd stood; then makes his way
O'er rocks and stones, following the dog
As quickly as he may;
Nor far had gone before he found
A human skeleton on the ground:
The appalled discoverer with a sigh
Looks round to learn the history.

From those abrupt and perilous rocks
The man had fallen, that place of fear!
At length upon the shepherd's mind
It breaks, and all is clear:
He instantly recalled the name,
And who he was, and whence he came;
Remembered, too, the very day
On which the traveller passed that way.

But hear a wonder for whose sake
This lamentable tale I tell!
A lasting monument of words
This wonder merits well.
The dog, which still was hovering nigh,
Repeating the same timid cry,
This dog had been through three months' space
A dweller in that savage place.

Yes, proof was plain that since the day
When this ill-fated traveller died,
The dog had watch'd about the spot,
Or by his master's side:
How nourished there through that long time,
He knows who gave that love sublime;
And gave that strength of feeling great,
Above all human estimate.

SHE IS FAR FROM THE LAND

Thomas Moore, the celebrated Irish poet, is likely to be remembered in time to come chiefly for his exquisite songs, of which "The Minstrel Boy," on page 546, is one of the best examples. The following is another of his tuneful lyrics. "The Island of Sorrow" referred to in the last line is, of course, the poet's native land of Ireland.

SHE is far from the land where her young hero sleeps,
And lovers are round her, sighing;
But coldly she turns from their gaze, and weeps,
For her heart in his grave is lying.

She sings the wild song of her dear native plains,
Every note which he loved awaking;
Ah, little they think who delight in her strains
How the heart of the minstrel is breaking.

He had lived for his love, for his country he died,
They were all that to life had entwined him;
Nor soon shall the tears of his country be dried,
Nor long will his love stay behind him.

Oh, make her a grave where the sunbeams rest,
When they promise a glorious morrow;
They'll shine o'er her sleep like a smile from the West,
From her own loved island of sorrow.

THE OLD FAMILIAR FACES

Charles Lamb is one of the most attractive characters in the whole history of English literature. His fame rests chiefly on his charming essays, as he gained no great distinction in poetry. Together with his sister Mary, he wrote a number of poems for children, several of which appear in our pages, though the following lines in blank verse cannot be described as juvenile poetry. The sentiment which they convey, however, is so human and so universal—the pathos of looking in vain for "the old familiar faces" when one has lived through the long years, lingering after one's friends have all departed—that they really appeal to "children of all ages."

I HAVE had playmates, I have had companions,
In my days of childhood, in my joyful school-days—
All, all are gone, the old familiar faces.

I have been laughing, I have been carousing,
Drinking late, sitting late, with my bosom cronies—
All, all are gone, the old familiar faces.

I loved a love once, fairest among women,
Closed are her doors on me, I must not see her—
All, all are gone, the old familiar faces.

I have a friend, a kinder friend has no man.
Like an ingrate, I left my friend abruptly;
Left him, to muse on the old familiar faces.

Ghost-like, I paced round the haunts of my childhood.
Earth seem'd a desert I was bound to traverse,
Seeking to find the old familiar faces.

Friend of my bosom, thou more than a brother,
Why wert not thou born in my father's dwelling?
So might we talk of the old familiar faces.

How some they have died, and some they have left me,
And some are taken from me; all are departed;
All, all are gone, the old familiar faces.

CUDDLE DOON

One of the finest poems of childhood, "Cuddle Doon," derives not a little of its beauty from the quaint Scots tongue in which it is written. It is just a simple picture of what happens every night in millions of homes. Many of the words are peculiar to Scotland and the north of England. "Muckle faught" means much noise or disturbance; "waukrife" means wakeful; "hap" is to cover up; "kittlin" is the Scots for tickling; to "steek" the door is to shut and bolt it; to "straik each croon" is to stroke each head or crown; "quaten doon" is to quiet down; "ilka ane" means each one, and "pow" is, of course, a head, or, more correctly, the top of the head. Alexander Anderson, whose fame rests almost entirely on this one gem of Scottish poetry, was a working man employed on the railway in Scotland, and his verses were written over the signature of "Surfaceman." Born at Kirkconnel, Dumfriesshire, on April 30, 1845, he eventually became, thanks to his poetic gifts and his self-application to literary studies, librarian to Edinburgh University, where he remained until his death, in 1909.

THE bairnies cuddle doon at nicht
  Wi' muckle faught an' din;
"Oh, try and sleep, ye waukrife rogues,
  Your faither's comin' in."
They never heed a word I speak;
  I try to gie a froon;
But aye I hap them up an' cry,
  "Oh, bairnies, cuddle doon!"

Wee Jamie wi' the curly heid—
  He aye sleeps next the wa'—
Bangs up an' cries, "I want a piece,"
  The rascal starts them a'.
I rin an' fetch them pieces, drinks,
  They stop awee the soun',
Then draw the blankets up an' cry,
  "Noo, weanies, cuddle doon!"

But ere five minutes gang, wee Rab
  Cries out, frae 'neath the claes,
"Mither, mak' Tam gie ower at ance,
  He's kittlin' wi' his taes."
The mischief's in that Tam for tricks,
  He'd bother half the toon;
But aye I hap them up an' cry,
  "Oh, bairnies, cuddle doon!"

At length they hear their faither's fit,
  An', as he steeks the door,
They turn their faces to the wa',
  While Tam pretends to snore.
"Hae a' the weans been gude?" he asks,
  As he pits aff his shoon;
"The bairnies, John, are in their beds,
  An' lang since cuddled doon."

An' just afore we bed oorsel's,
  We look at our wee lambs,
Tam has his airm roun' wee Rab's neck,
  And Rab his airm roun' Tam's.
I lift wee Jamie up the bed,
  An' as I straik each croon,
I whisper, till my heart fills up,
  "Oh, bairnies, cuddle doon!"

The bairnies cuddle doon at nicht,
  Wi' mirth that's dear to me;
But soon the big warl's cark an' care
  Will quaten doon their glee.
Yet, come what will to ilka ane
  May He who rules aboon
Aye whisper, though their pows be bald,
  "Oh, bairnies, cuddle doon!"

COMMON NATURES

Aaron Hill, the writer of these lines, was born in 1685, and died in 1750. He was famous in his day as a poet and playwright but has long since been forgotten except for such occasional quotations from his writings as the little poem we give here.

TENDER-HANDED stroke a nettle,
  And it stings you for your pains:
Grasp it like a man of mettle
  And it soft as silk remains.

'Tis the same with common natures:
  Use them kindly, they rebel;
But be rough as nutmeg-graters,
  And the rogues obey you well.

DISPUTE BETWEEN NOSE AND EYES

William Cowper in this quaint little poem would seem to be having a sly dig at the lawyers, for there can be no doubt that the decision of Baron Ear is distinctly absurd, being based on the arguments of Lawyer Tongue, who, having used all his skill in pleading the case of Nose, had, unfortunately, left himself without a good case for Eyes.

BETWEEN Nose and Eyes a strange contest arose,
  The spectacles set them unhappily wrong;
The point in dispute was, as all the world knows,
  To which the said spectacles ought to belong.

So Tongue was the lawyer, and argued the cause
  With a great deal of skill, and a wig full of learning,
While chief Baron Ear sat to balance the laws,
  So famed for his talent in nicely discerning.

"In behalf of the Nose, it will quickly appear,
  And your lordship," he said, "will undoubtedly find
That the Nose has had spectacles always in wear,
  Which amounts to possession—time out of mind."

Then holding the spectacles up to the court—
  "Your lordship observes they are made with a straddle,
As wide as the ridge of the Nose is—in short,
  Designed to sit close to it, just like a saddle.

"Again, would your lordship a moment suppose
  ('Tis a case that has happened, and may be again),
That the visage or countenance had not a Nose,
  Pray who would, or who could, wear spectacles then?

"On the whole it appears, and my argument shows,
  With a reasoning the court will never condemn,
That the spectacles plainly were made for the Nose,
  And the Nose was as plainly intended for them."

Then shifting his side (as a lawyer knows how)
  He pleaded again in behalf of the Eyes;
But what were his arguments few people know,
  For the court did not think they were equally wise.

So his lordship decreed with a grave, solemn tone,
  Decisive and clear, without one "if" or "but,"
That, whenever the Nose put his spectacles on,
  By daylight, or candle-light, Eyes should be shut.

THE CASTLE-BUILDER

Famous among the writers of France is Jean de Lafontaine, born 1621, died 1695. Although an idle and good-for-nothing sort of fellow, he was a writer of great and original gifts. He is best remembered for his fables in verse, which have often been translated into English, and a typical example of which is here given. Every boy and girl is, no doubt, familiar with the "moral" of this fable, which is just the old saying, "Never count your chicks before they're hatched."

IT happened on a summer's day,
A country lass as fresh as May,
Decked in a wholesome russet gown,
Was going to the market town;
So blithe her looks, so simply clean,
You'd take her for a May-day queen;
Though for her garland, says the tale,
Her head sustained a loaded pail.
As on her way she passed along,
She hummed the fragments of a song;
She did not hum for want of thought—
Quite pleased with what to sale she brought,
She reckoned by her own account,
When all was sold, the whole amount.
Thus she—"In time this little ware
May turn to great account with care:
My milk being sold for—so and so,
I'll buy some eggs as markets go,
And set them; at the time I fix,
These eggs will bring as many chicks;
I'll spare no pains to feed them well;
They'll bring vast profit when they sell.
With this, I'll buy a little pig,
And when 'tis grown up fat and big,
I'll sell it, whether boar or sow,
And with the money buy a cow:
This cow will surely have a calf,
And there the profit's half in half;
Besides, there's butter, milk, and cheese,
To keep the market when I please:
All which I'll sell, and buy a farm,
Then of sweethearts have a swarm.
Oh, then for ribands, gloves, and rings!
Ay, more than twenty pretty things—
One brings me this, another that,
And I shall have—I know not what!"
Fired with the thought, the sanguine lass,
Of what was thus to come to pass
Her heart beat strong; she gave a bound
And down came milkpail on the ground:
Eggs, fowl, pig, hog (ah, well-a-day!)
Cow, calf, and farm—all swam away!

BEAUTIFUL THINGS

This little poem by Ellen P. Allerton tells us that true beauty lies in something more than loveliness of form and face.

BEAUTIFUL faces are those that wear—
It matters little if dark or fair—
Whole-souled honesty printed there.

Beautiful eyes are those that show,
Like crystal panes, where hearth-fires glow,
Beautiful thoughts that burn below.

Beautiful lips are those whose words
Leap from the heart like songs of birds,
Yet whose utterance prudence girds.

Beautiful hands are those that do
Work that is earnest, and brave, and true,
Moment by moment, the long day through.

Beautiful feet are those that go
On kindly ministries to and fro,
Down lowliest ways, if God wills it so.

Beautiful shoulders are those that bear
Ceaseless burdens of homely care,
With patient grace and daily prayer.

Beautiful lives are those that bless—
Silent rivers of happiness,
Whose hidden fountains but few may guess.

Beautiful twilight at set of sun;
Beautiful goal, with race well won;
Beautiful rest, with work well done.

Beautiful graves, where grasses creep,
Where brown leaves fall, where drifts lie deep
Over worn-out hands—oh, beautiful sleep!

WHAT BOBBIE WOULD LIKE

By permission of Mr. Frederic E. Weatherly we are able to read here these pretty verses from the pen of that famous song-writer, who, although he has written so much for the grown-ups, takes pleasure every now and then in turning his pen to write of childhood and children's thoughts.

I'D like to be a farmer,
With lots of stacks and mows,
And fowls and pigs, and carts and gigs,
And four-and-twenty cows.
I'd drive them all to market,
On summer mornings fine;
"Oh, come and buy," I'd stand and cry,
"Buy, buy, good masters mine!"
But if they would not buy them,
It would not give me pain;
I'd simply say: "Fair sirs, good-day!"
And drive them home again.

I wish I were a farmer,
With lots of lambs and sheep,
I'd run and play with them all day,
Until we went to sleep.
I'd take the wool to market
On summer mornings fine—
"Oh, come and buy," I'd stand and cry,
"Buy, buy, good masters mine!"
But if they would not buy my wool,
It would not cause me pain,
I'd come and say: "Dear sheep, good-day.
Here is your wool again."

And if they could not put it on,
I'd put it on myself;
And all the rest, when I was drest,
I'd lay upon the shelf.
For when the winter days come round,
And all the world is cold,
I know full well my wool will sell
For all its weight in gold.
And so I'll be a farmer,
Right happy in my lot,
And he who cares may buy my wares,
And other folk need not!

THE CAGED BIRD

These lines are by William Lisle Bowles, a clergyman and poet of great distinction in his day, whose poems were admired by such great writers as Coleridge and Wordsworth. His works are now little read, and are familiar only to literary students. He was born in 1762 and died in 1850.

OH, who would keep a little bird confined
When cowslip bells are nodding in the wind,
When every hedge as with "good-morrow" rings,
And, heard from wood to wood, the blackbird sings?
Oh, who would keep a little bird confined
In his cold wiry prison?—Let him fly,
And hear him sing: "How sweet is liberty!"

LITTLE VERSES FOR VERY LITTLE PEOPLE

The writing of nursery rhymes is by no means so easy as one might imagine. Perhaps that is why so few good rhymes, which are really worth calling nursery rhymes, are written nowadays. When people think things are easy to do, they are apt to neglect them, or to do them in a slipshod way. But Miss Lawrence Alma Tadema, who is a daughter of Sir Lawrence Alma Tadema, the celebrated painter, has wisely thought it worth while to write nursery rhymes well, and, as a result, we have had many charming little verses of this kind from her pen. A selection from these is given on this page and the next. Like all that she has written, they have real musical movement in them, and, indeed, many of her poems for little folk have been set to music with great success.

MARCH MEADOWS

A Lark

LARK-BIRD, lark-bird soaring high,
Are you never weary?
When you reach the empty sky,
Are the clouds not dreary?
Don't you sometimes long to be
A silent goldfish in the sea?

Goldfish, goldfish diving deep,
Are you never sad, say?
When you feel the cold waves creep,
Are you really glad, say?
Don't you sometimes long to sing
And be a lark-bird on the wing?

Lambs

O little lambs! the month is cold,
The sky is very gray;
You shiver in the misty grass
And bleat all the winds that pass;
Wait! when I'm big—some day—
I'll build a roof to every fold.

But now that I am small, I'll pray
At mother's knee for you;
Perhaps the angels with their wings
Will come and warm you, little things;
I'm sure that, if God knew,
He'd let the lambs be born in May.

A TWILIGHT SONG

BABY moon, 'tis time for bed,
Owlet leaves his nest now;
Hide your little horned head
In the twilight west now;
When you're old and round and bright
You shall stay and shine all night.

Baby girl is going, too,
In her bed to creep now;
She is little, just like you,
Time it is to sleep now;
When she's old and tired and wise,
She'll be glad to close her eyes.

THE NESTING HOUR

ROBIN-FRIEND has gone to bed,
Little wing to hide his head—
Mother's bird must slumber, too,
Just as baby robins do—
When the stars begin to rise,
Birds and babies close their eyes.

PLAYGROUNDS

IN summer I am very glad
We children are so small,
For we can see a thousand things
That men can't see at all.

They don't know much about the moss
And all the stones they pass;
They never lie and play among
The forests in the grass.

They walk about a long way off;
And, when we're at the sea,
Let father stoop as best he can
He can't find things like me.

But, when the snow is on the ground
And all the puddles freeze,
I wish that I were very tall,
High up above the trees.

THE NEW PELISSE

BABY'S got a new pelisse,
Very soft and very neat—
Like a lammy in her fleece
She's all white from head to feet.

Thirty lambs each gave a curl,
Mother sewed them, stitch by stitch—
All to clothe a baby-girl:
Don't you think she's very rich?

THE LITTLE SISTER

Bath-time

BABY'S got no legs at all;
They're soft and pinky, crumpled things.
If he stood up he'd only fall;
But then, you see, he's used to wings.

Bed-time

Baby, baby, bye,
Close your little eye!
When the dark begins to creep,
Tiny-wees must go to sleep.

Lammy, lammy, lie,
I am seven, I;
Little boys must sleep and wait,
If they want their bed-time late.

Fidgy, fidgy, fie,
There's no need to cry!
Soon you'll never dress in white,
But sit up working half the night.

IF NO ONE EVER MARRIES ME

IF no one ever marries me—
  And I don't see why they should;
For nurse says I'm not pretty,
  And I'm seldom very good—

If no one ever marries me,
  I shan't mind very much;
I shall buy a squirrel in a cage,
  And a little rabbit hutch.

I shall have a cottage near a wood,
  And a pony of my own,
And a little lamb quite neat and clean
  That I can take to town.

And when I'm getting really old,
  At twenty-eight or nine,
I shall buy a little orphan girl
  And bring her up as mine.

KING BABY ON HIS THRONE

KING BABY on his throne
  Sits reigning O, sits reigning O!
King Baby on his throne
Sits reigning all alone.

His throne is mother's knee,
  So tender O, so tender O!
His throne is mother's knee,
Where none may sit but he.

His crown it is of gold,
  So curly O, so curly O!
His crown it is of gold,
In shining tendrils rolled.

His kingdom is my heart,
  So loyal O, so loyal O!
His kingdom is my heart,
His own in every part.

Divine are all his laws,
  So simple O, so simple O!
Divine are all his laws,
With love for end and cause.

King Baby on his throne
  Sits reigning O, sits reigning O!
King Baby on his throne
Sits reigning all alone.

When books were scarce and costly, copies were often placed in cathedrals for the use of the people, but they were chained up for safety, as shown in this picture of books still in Hereford Cathedral.

MEN WHO GAVE US PRINTING

CONTINUED FROM 3565

GUTENBERG

IT will help us to understand this story if we read on page 943, and the pages that follow, the story of printing as it is done to-day. That story makes us familiar with the terms used and the methods now employed.

It is difficult to think what the lives of the great mass of the people were like in the days when they had nothing to read. They could not have been much better off in things affecting the mind than savages of our own time. A few stories and legends were passed on by word of mouth, but that was the only help the imagination had. People lived in the densest ignorance.

A rich man, we might think, would be proud to be wise and learned. But in those days the rich man was very ignorant as a rule. So far from being able to read, he considered reading and writing altogether too lowly an occupation for him. There were those who could write, and who could teach him to write, but that would never do for the powerful rich man of those early days. He paid poor monks and clerks to write for him. He would not even sign his name. To sign his name was like putting on his armor—something that he paid a vassal to do for him. Gradually there grew up a demand for knowledge. But there was little to meet the demand. There were not as many books in all Europe as one great library possesses to-day. Each book took perhaps months to make, and the world would have been better without some of the books that did then exist, for these books simply appealed to the superstitions of men, and gave them no new knowledge.

There were some better books, of course. There were a few written copies of books that had been composed by the great writers of Greece and Rome. These were very highly prized by the few who knew of them and loved them. Thus we find that a man, wishing to buy a country house near Florence, sold his copy of a famous book, and the man who bought it sold a piece of land to get the money to pay for it. The longing for books was increasing, but the power to produce them more rapidly did not keep pace with the demand. Thus the need for some grand new invention to give people books was very urgent when John Gutenberg, the inventor of proper printing, was born, at Mainz, in Germany, about 1400.

GUTENBERG, THE ALMOST UNKNOWN MAN WHOM ALL MEN HONOR

It is a curious thing that printing, which records the history, so far as it is known, of every other invention, should tell us so little of its own story. We do not know with whom the idea of printing first began. It is generally believed that Gutenberg was the first man in history to give the world a book printed with separate pieces of movable type, but the credit of the invention is claimed for other men who lived at the same time as he. We do not even know exactly the year of Gutenberg's birth. The date generally accepted is the year 1410, but it is also stated to have occurred eleven years earlier. We know nothing about his boyhood. His work caused the greatest revolution in the history of knowledge that the world has ever witnessed, yet we are as ignorant of the story of his private life as if he had been an ordinary citizen.

The reason for the confusion as to the actual invention of printing may be a little easier to understand if we take a glance at the attempts at book-making which were being made when Gutenberg was a youth. The idea that there was a better way of producing books than writing them by hand had already entered men's minds. Men had found out the way to print from what we call woodcuts. These were drawings cut into blocks of wood, which, on being inked over, printed a picture on the paper pressed upon them.

HOW MEN LEARNED TO PRINT PICTURES BEFORE THEY COULD PRINT WORDS

That was picture-printing, and it made men familiar with the thought of tracing figures upon paper by means of carved wood, from which many copies could be printed.

But that was a long way from printing a book from types which, when one book had been printed, could be used again and again to print other books. The woodcuts gave only pictures; the title was also cut. It took, you can see, a long time to carve a page of words on a block of wood, and it would have been impossible to print many books for which every page of matter needed a separate block of wood. What they wanted was a number of movable letters that could be put together to form words, and then when the page was printed the letters, or types, could be distributed, and set up again to form other pages. It fell to Gutenberg to invent this wonderful scheme—or that, at any rate, is the decision of many historians.

Rival historians tell a different tale. They say that a man named Lourens Janszoon Coster, of Haarlem, Holland, was the inventor of the movable types, that he actually printed a book from them; and that then his servant stole the types and ran away with them to Gutenberg, whose service he entered and whom he taught to print.

HOW GUTENBERG'S PARENTS WERE DRIVEN FROM MAINZ BY A MOB

The story about Coster was not printed until many years after the death of Gutenberg. There is no evidence that Coster made a claim of any sort against Gutenberg, and indeed for many years most people thought that Coster had never existed. On the other hand, in 1499, the story, that the first invention of printing was made in Holland, was printed at Cologne. It would take too long to tell all the arguments on each side. We can only say that the Germans claim that Gutenberg was the inventor of movable type, while the Dutch make the same claim for Coster.

Let us now take the life-story of Gutenberg as far as we know it. His parents were of noble birth. His father's name was Gensfleisch, but he took the name of Gutenberg in honor of his mother who was born there, and who was the last descendant of her house. She little thought what honor and glory he would bring upon her name. When John was about ten years of age his parents had to flee from Mainz. There was a great quarrel between the poor and rich of the city, and his parents, who were among the rich, were forced to fly and take their little boy with them. They settled in Strasburg, and there the inventor of printing grew up.

Some years before he made any attempt to print books, we read of him as being engaged in experiments for polishing stones and making mirrors. He required more money than he was able to secure from his people at home, therefore he induced a citizen, named Andrew Dritzehn, to become security for him, so that he could borrow the money elsewhere.

A BUSINESS IN LOOKING-GLASSES THAT FAILED, AND WHAT CAME AFTERWARDS

Dritzehn must have thought highly of Gutenberg, for he entered into partnership with him, the business being the polishing of stones and the making of mirrors. Of course, looking-glasses had been made before this, but Gutenberg had found out a way of making better ones than had been known before. The partners seem to have been successful at first and to have remained in this business for some years. A lucky accident, perhaps, took them out of it. There was to be a pilgrimage to Aix-la-Chapelle, and they had counted on selling a great many mirrors. The pilgrimage was postponed, and the stock remained unsold.

This seems to have put an end to the business. Gutenberg now turned to the work of his life. He took into partnership two other men, named Andrew Heilmann and Anton Heilmann; his former partner, Dritzehn, also was in the business. It is thought that they began as printers, but probably their first idea was to use wood-cuts. The partners must have thought well of the business, for when, in 1441, Dritzehn died, his brothers went to law to try to make Gutenberg take them into partnership in the dead man's place. Gutenberg won the day. He neither had to take the brothers into partnership, nor had he to reveal the secrets of his business.

GUTENBERG'S RETURN HOME AFTER HIS LONG EXILE

After this comes a period of mystery. Gutenberg borrowed money for carrying on his experiments, and that is all we know. All his money seems to have gone in his work, for there is a record showing that his wife paid the taxes for his house during this time. Then something seemed to call him to his old home. Perhaps he felt that, as he was about to make known his great art to the world, his native Mainz ought to be its cradle. He returned to Mainz about 1446, after having been an exile over twenty-five years. He made his home in a house which formed part of the possessions of his family. It is believed that he had now completed his scheme for the new printing from the fact that he was able to borrow money from a shrewd merchant of Mainz, named John Fust. The latter provided two sums of money to enable him to make his "tools" and to purchase other materials. As security Fust had all the printing stock which Gutenberg was to make.

The story told is that they took into their service a skilful worker in metal named Schoeffer, who was able greatly to assist Gutenberg in carrying out his ideas in the making of the type. Gutenberg is said to have set out to make each letter separately. If he wanted 100 copies of the letter A, he would set to work to carve 100 copies of the letter in wood.

THE FIRST BIBLE PRINTED IN THE WORLD

But this was too slow; besides, the wooden letters were too soft to last. The improvement that Schoeffer is said to have suggested was important. He carved the letter on the end of a piece of metal. With this metal letter he punched a mold in a softer metal. Then all that remained to be done was to melt metal and pour it into the mold, and copies of the letter could be made as fast as the metal would harden.

The fact that Schoeffer did this for Gutenberg was very important, but does not take any credit from Gutenberg. The first great idea was Gutenberg's; the carrying out of the details owed much to Schoeffer, who was the very man that Gutenberg wanted at the time.

And now the work of Gutenberg's life was begun. He had determined to print a copy of the Bible. It took a long time to do it, and the cost was very heavy. The printers had everything to do. They had to make their types, they had to set them up and correct them, then print the pages and set up and correct and print others. There never was enough money for the work. Before the first three pages had been printed 3,000 florins had been spent, and Gutenberg was always haunted by the fear that there would not be nearly enough money to carry out the work.

At last, in 1455 or 1456, the complete Bible in the Latin tongue, bound in two great volumes, was presented to the world. The triumph of printing was at once established. Men agreed that it was "as clear as handwriting," and that, seeing that many copies had been printed at the same time, the cost was far lighter than that of copying

by men, while the work was done far more quickly.

THE DISASTER THAT OVERTOOK GUTENBERG IN THE HOUR OF HIS TRIUMPH

But Gutenberg's sun set as soon as it rose. No sooner had the great Bible been printed than a quarrel arose. Gutenberg and his partner had done a great and splendid thing in giving to the world a noble Bible as the first-fruits of the printing press. It is something of which printers have ever since been proud, that one of the first books printed by this new process was the greatest and holiest book in the world.

But when that work was ended, strife at once broke out. The wealthy Fust claimed back the money he had lent. He knew that Gutenberg could not pay him, and that, perhaps, was why he immediately pressed his claim. As he could not have the money he seized all the printing plant. He was legally entitled to do this, but many things are legal which are very cruel. Poor Gutenberg, in the very hour of his triumph, was turned out of his office, and his beloved press was left to Fust and Schoeffer, while he was poorer than when the idea of printing first entered his brain.

However, he was not to die without another effort to further his work. He found a good friend in Dr. Conrad Humery, who enabled him to set up another press, from which he printed one or two books.

THE SAD ENDING OF A LIFE THAT HELPED TO CHANGE THE WORLD

But nothing prospered with Gutenberg after that, and he ended his days as a pensioner, living on the bounty of the Archbishop of Mainz. Nobody noted his death. He passed away in 1468, thirteen years after the completion of the work which made him one of the world's great men. Nearly four centuries afterwards the citizens of Mainz erected a statue in his honor. He needed it not then. His fame had gone forth into all lands. Within sixteen years of the printing of the first Bible the art of printing was being practised in the principal cities of Germany and Italy. Presses sprang up in Strasburg, Cologne, Rome, Florence, Naples, Bologna, and Milan. In England people were too busy with the Wars of the Roses to notice the miracles that were being performed. But for them, too, came the hour and the man.

It was in 1477 that the very first book was printed in England. It was a great time for England, for it marked the dawn of English learning. Remember that from the Norman Conquest until about a hundred years before this time the English language was not taught in that country. French was taught for reading and writing by the upper classes; but until Chaucer's day, there was little written English and all documents were written in French or Latin. Now the English people were to have books printed in their mother-tongue, and the man who was to do this was William Caxton, whose name is honored in England as much as that of Gutenberg and the other men of his age who all helped forward the great art.

WILLIAM CAXTON, THE MAN WHO CARRIED PRINTING TO ENGLAND

Caxton was born in Kent about 1422, so that he was younger than Gutenberg. In these days we should think it strange if parents did not educate their children. It was different in Caxton's days, and when he was an old man he used to say that he always felt bound to pray for the soul of his father and mother, because they had sent him to school. They little thought when they put their boy to school what a great thing they were doing for the education of the whole English-speaking race. After he had quitted school they apprenticed him to a wealthy mercer, named Large, who afterwards became Lord Mayor of London, and thought so well of Caxton that at his death he left the youth a sum of money.

While he was still little more than a boy, Caxton went to Bruges, and was soon able to set up in business for himself. At that time several English merchants were engaged in business in Bruges, and Caxton, being an energetic and clever man, prospered. We have evidence of his prosperity in the fact that a few years after his arrival he became security for another merchant for the sum of £100, which would be a large amount in our money. So far as we know, Caxton went to England on only two occasions during the next thirty years. He made himself master of several languages, and became an ambassador at Bruges for the English

IN THE EARLY DAYS OF PRINTING

There has never been a more important invention than printing. The first man to print a book from movable type is said to have been John Gutenberg, who, at Mainz, about 1455, produced a Bible. A merchant named Fust lent Gutenberg money for his experiments, and when Gutenberg could not pay back, Fust seized his printing press and type, and turned him out of the office, at the moment of triumph, as we see here.

The art of printing soon spread over Europe, and here we see a famous printing office, that of Stradanus, at Antwerp, at the beginning of the 17th century. Many small printing offices to-day are something like this. The wooden boxes in which the type is kept have not changed at all from the pattern seen here. This picture is from a rare engraving in the British Museum, and the photograph of the Chained Library by W. H. Knowles.

king, who entrusted him with missions of importance.

HOW THE SACKING OF A CITY SCATTERED PRINTERS THROUGHOUT EUROPE

As we have seen, the knowledge of printing soon spread about Europe. It was largely helped in an unexpected direction. The city of Mainz, where it had begun, was sacked in 1462. The office of Fust and Schoeffer was wrecked, and their workmen were scattered. They spread into various countries, and took with them their knowledge of printing. Thus the misfortune of Fust proved a blessing in disguise to other people. Books multiplied, and printed copies came into the hands of Caxton.

When he was nearly fifty years of age he set to work to translate into English a book on the history of Troy. No doubt he had enjoyed reading it, and wished that people who knew only English should share his enjoyment. When he had translated it he caused it to be printed, and it appeared in Cologne, so far as is known, in 1474, six years after Gutenberg had been laid in his grave. We do not know whether Caxton actually set up the type and printed the book himself, or whether he paid someone else to do the work. We do know that he had been much in the company, in Bruges, of a man named Colard Mansion, a famous writer, who had become a printer.

THE BOOK THAT CAXTON PRINTED IN A WESTMINSTER ABBEY OFFICE

Whether the book was printed at Bruges or Cologne can never be decided, and it really does not matter. The point of importance for us is that, delighted with the new art of printing that he had mastered, Caxton left for England in 1476 to set up as a printer.

He took an office in premises belonging to Westminster Abbey. It is commonly supposed that he printed actually in the abbey. That, however, is not the case, for his office was in or near one of the almshouses which a king had founded. The book translated and printed abroad by Caxton was the first which had ever appeared in the English tongue. The first book ever printed in England was either his book on the game of chess, or one devoted to the sayings of the philosophers. He now had a busy time as a printer. He printed short stories and pamphlets; he printed the works of Chaucer, religious works, the Morte d'Arthur, and many others. Nearly a hundred of his books still exist; not all perfect, of course. Parts of some were found to have been used in binding later books; others had been nibbled by rats and carried to their holes in Westminster Abbey. Some of his books sell to-day for over $10,000 each.

One of the men who helped Caxton with his printing was Wynkyn de Worde, who went over with him from Belgium, and, at Caxton's death, in 1491, succeeded to his printing plant. He carried out the work which his master had begun. He improved the type, and printed over 400 books.

THE MEN WHO FOLLOWED CAXTON AND SPREAD PRINTING IN ENGLAND

But before the death of Caxton printing had made a great advance in England. Two years after Caxton's return to England a printing press was set up at Oxford by Thomas Rood. Two years after, one was started at St. Albans, by a man called the school-master. A man named Lettou started for himself in London in the same year. Cambridge waited for over forty years before setting up her first printing press.

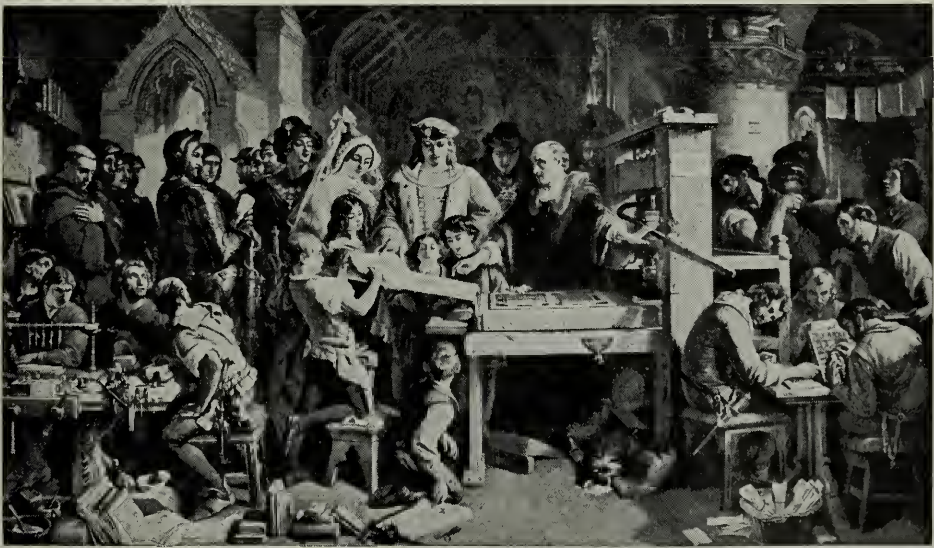
In the meantime, the art had spread far and near over the country, and Scotland had her first press in 1507, when two men named Walter Chepman, who found the money, and Andrew Myllar, a bookseller, who had been to France and learned how to print, obtained a license from the Scottish king, James IV., to set up in business as printers. The firm was not carried on after the death of these two men, and then for some years the Scottish Parliament, while having its Acts of Parliament printed, actually had to send to France to get the work done.

The art had now become firmly established in Europe. It spread to our American continent by the help of a Spaniard in Mexico, who in 1544 published the first book ever seen in the West. The first English book was published in 1639, or 1640, at Harvard College.

Of course, printing was not at first very good. The first improvements in type were made by Wynkyn de Worde. But the greatest were made by Richard Pynson. He, like Wynkyn de Worde, was a foreigner, whom Caxton had

PRINTING THE FIRST BOOK IN ENGLAND

When we speak of a revolution, we usually think of fighting and bloodshed, but in these pictures, peaceable as the scenes represented are, we see the beginning of one of the greatest revolutions in English history. Nothing has had such an effect upon the progress of the world, or so changed the characters of peoples and nations, as printing, and here we see William Caxton, who introduced printing into England in 1476, reading the first proof sheet from his printing press in premises belonging to Westminster Abbey.



Caxton set up his printing press in the Almonry of Westminster Abbey, and there, while the nation was in a state of turmoil, Caxton worked away perfecting his art and producing books. While living at Bruges he had printed one or two books in English, but the first book that is definitely known to have been printed in England is the "Dictes and Sayings of the Philosophers," although the earlier "Game and Play of the Chess" may also have been printed there. Here we see King Edward IV. and his queen visiting Caxton.

brought over to London. Pynson became printer to the king of England, and performed a most important service to English printing by introducing Roman type, like that which appears on this page.

One of the most famous of continental printers was Aldo Manuzio, of Venice, who was born in that beautiful city about 1446. With him began the practice of printing, in addition to the ordinary copies of a book, some few copies on especially good paper and in fine bindings. Manuzio was the first to make the type called *italic*, type like that in which the word itself is here printed. It is believed that he took as his model for this type the beautiful handwriting of the great poet Petrarch.

THE GOVERNMENT TRIED TO KEEP KNOWLEDGE FROM THE PEOPLE

As printed books appeared in England, education became better and more common, so that many people were able to read and discuss the events printed in books and pamphlets. This alarmed the government, and in 1530 what is known as a press censorship was established. If a man printed anything not approved by the censor he was cruelly punished. This state of things lasted more than 150 years, and the lot of the printer was so hard that printing became almost a lost art again. Men would not risk imprisonment and fines to publish works which the people wanted, but which the tyrannical censor might condemn. Even before the appointment of a censor, books had been seized and burned by the church. Not until 1694 was the office of censor swept away.

When the censor ceased to be, men plucked up hope again, and printing soon began to improve. Better type was made, but still the printing machinery continued to be pretty much what it had been from the first.

In these old hand presses, the type was set and fastened, or "locked," on a flat heavy "bed." The type was carefully inked over by the use of stuffed leather balls which were made for the purpose of spreading the ink; a sheet of paper was laid on the locked type, the heavy bed of the machine was pushed under the press, which was screwed down by hand until it was tight enough to cause the paper to receive an impression from the inked surface of the types. The same laborious process had to be gone through for each sheet, and each side of the sheet, and so we cannot wonder that books were scarce and dear and newspapers few in number.

IMPROVEMENTS MADE IN PRESSES IN THE EIGHTEENTH CENTURY

Just before the time of the French Revolution, a Frenchman named Pierre made an iron press, which was much better than the old wooden ones. It was brought to England, and there the Earl of Stanhope, who was of a mechanical turn of mind, invented many improvements on it. By the use of these devices it became possible to run the type under the press more easily, and to screw the press down more quickly. Improvements were made in the Stanhope Press during the early nineteenth century, and some of these old hand presses are still used for very fine, hand-printed books. The best of them need two men to work them, and at their greatest rate of speed, between two and three hundred pages only can be printed in an hour. As our great newspapers print a large edition inside of an hour, you can see that many inventions have been made since that time. The favorite hand presses in the United States in use were the Columbian Press and the Washington Press, and some of the old books that you often see in libraries or on your grandfather's bookshelves were printed on them. Many small presses that are now used for what is called "job printing" are the same presses improved by the addition of a treadle, something like the treadle of a sewing machine, so that they can be run by foot. In large printing offices these presses are run by an engine of some sort or by an electric motor. The best of them had improvements made by George P. Gordon of New York, and leaflets, programmes, school magazines and so on are generally printed on the Gordon Press.

THE MEN WHO INVENTED MODERN NEWSPAPER PRESSES

As newspapers grew in size and circulation, the old presses were found to be too slow. William Nicholson, of London, in 1790, got an idea that the paper might be fastened to a cylinder which could be rolled over the type. He also thought that the type might be fastened to a cylinder. He was not a printer, but an author and an editor, and he could not make the machine work. Frederick

König, a German printer living in London, took up one of these ideas and persuaded the London Times to try it. In 1814 two presses were completed for that newspaper. The types were placed on a flat bed, which rolled under a cylinder. The press was worked by steam power and could not print over a thousand copies an hour on one side of the paper. Improvements were made in this press also, and presses of very much the same kind are often used now to print books.

Next came the "Hoe Type Revolving Machine," on which the type was fastened to a revolving cylinder which touched other cylinders round which the paper was drawn. With this press 8,000 copies could be printed every hour, and soon an improvement was made and 20,000 could be printed. Up to this time, no newspaper had a very large circulation, for it could not print many papers in a day. This invention made possible the newspaper of to-day.

The next improvement was made by William Bullock, of Philadelphia, who invented a press with cylinders which cut the sheets from a continuous roll of paper and printed them, and after that came the invention by which type for each day is made in the form of a cylinder in the way that has been described in the story told on page 943.

Since that time further improvements have been made in the Hoe Press, and a press has been built which will print, cut and fold 300,000 copies of an eight-page newspaper in an hour. It is a wonderful thing to watch these presses at their work. When the time to print the newspaper arrives the cylinders are fastened in their places, the ends of the great rolls of paper are led into the guides that feed them to the cylinders over which they are to travel; the great press is set in motion, and in a few minutes the newsboys are crying their wares on the street. These huge presses are built in tiers, and the men who tend them have to mount ladders to reach the top. The presses not only print the newspapers on both sides of the paper at once, but cut the paper, and fold the sheets.

BOOKS ARE PRINTED ON SMALLER PRESSES

These presses, however, are much too large for the printing of books, and work much too rapidly to do beautiful printing. Therefore, books are printed on smaller presses, such as you may see in the story of how a book is made.

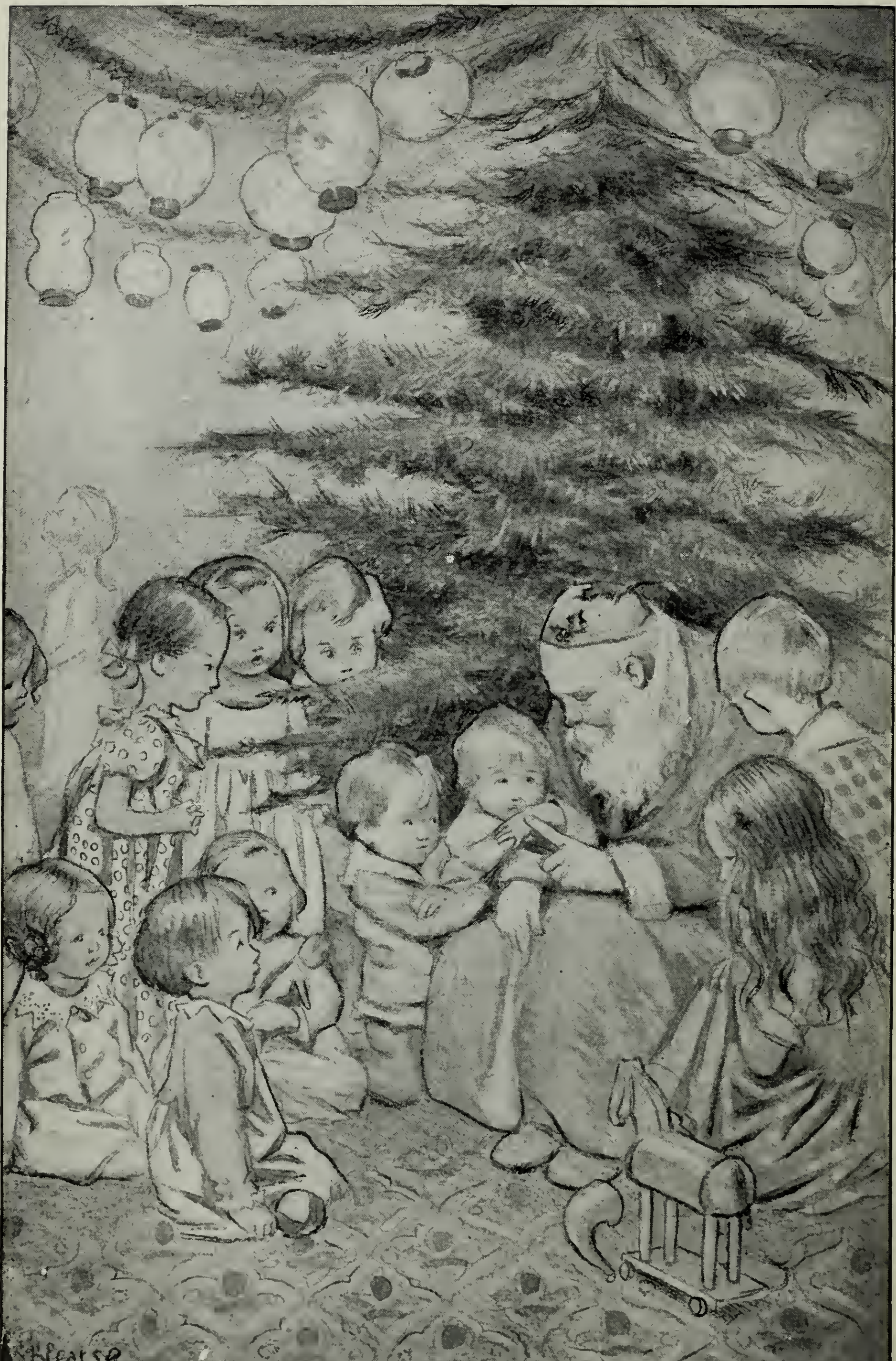
Printing ink is not, of course, the kind of ink that you use in your ink bottles, nor is it, as one little girl thought, applied to the paper through something like a typewriter ribbon. The ink used is a mixture which is composed chiefly of boiled oil, the black soot left by smoke, and some sort of coloring. This ink is spread on the face of an elastic cylinder which is rolled over the surface of the type, either by hand, in the case of a hand press, or by machinery. The ink rollers are made of glue, glucose, glycerine and sugar, and feel in the hand like a very elastic ball. This elasticity enables them to spread the ink very smoothly and evenly, and so there are no blurs on the beautiful pages of our books.

The Times steam press was the biggest advance in printing made since the day of Gutenberg himself. Since then new inventions for printing have followed each other with great rapidity. Printing colored pictures has become one of the most wonderful of the printer's triumphs. For the setting of type, machines have been made which seem to do all but think; while the great machines that print the papers and books of the present day are among the most marvelous contrivances ever invented by the genius of man.

Clerk Maxwell, of whom we have read elsewhere, was the first man who suggested that pictures might be printed in colors. The idea was taken up and experiments were made by several men; but the first man who devised blocks from which the printing could be done was Frederic Eugene Ives, who was born at Litchfield, Connecticut, in 1856. When he left the public schools, where he received his education, he learned photography as an occupation. The scientific side of his work was of most interest to him and when he was only eighteen we find him in charge of the photographic laboratory at Cornell University, where he stayed three years. He it was who invented the process by which all the thousands of pictures in this book are printed, whether they are black and white or are printed in colors. We leave you to say whether or not you think his name ought to be remembered by all of the many thousand readers of THE BOOK OF KNOWLEDGE.

THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 3765.

THE OLD MAN TOLD THEM THE STORY



The old man told the story of Humpty Dumpty, who fell downstairs, and yet came to the throne and won the Princess. The children clapped their hands. The Fir-tree stood, meanwhile, quite silent and thoughtful.

THE DISCONTENTED FIR-TREE

CONTINUED FROM 3504

FAR away in the deep forest there once grew a pretty Fir tree. The sun shone full upon him, the breeze played freely around him, and in the neighborhood grew many companion fir-trees, some older, some younger. But the little Fir-tree was not happy.

"Oh, that I were as tall as the others are," sighed the little Tree, "then I should spread out my branches so far, and my crown could look out over the wide world around! The birds would build their nests among the branches, and when the wind blew I should bend my head just as the others do."

The wood-cutters came in the autumn and felled some of the largest of the trees; this happened every year, and our young Fir, who was by this time a tolerable height, shuddered when he saw those magnificent trees fall with a tremendous crash to the earth. They were laid in wagons, and horses drew them away, far, far away from the forest.

Where could they be going? What might be their fortunes?

So, next spring, when the Stork returned from abroad, the Tree asked him, saying: "Know you not whither they are taken?"

The Stork looked thoughtful, then he nodded his head, and said:

"As I was flying from Egypt to this place, I met several ships with splendid masts. I have little doubt that they were the trees you speak of; they smelled like fir-wood. They sailed gloriously, quite gloriously!"

"Oh, that I, too, were tall enough to sail upon the sea!" sighed the Fir-tree.

"Rejoice in thy youth!" said the Sunbeam. "Rejoice in thy youth, in the fresh life that is within thee!"

And the Wind kissed the Tree, and the Dew wept tears over him; but the Fir-tree understood them not.

When Christmas approached, many of the young trees were felled; they were chosen from the most beautiful, their branches were cut off, and they were taken away.

"Where are they going?" asked the Fir-tree.

"We know! We know!" twittered the sparrows. "We peeped in through the windows of the town below! We know where they are gone! We looked through the window-panes, and saw them planted in a warm room, decked out with such beautiful things—gilded apples, candies, playthings, and hundreds of bright candles!"

"And then?" asked the Fir-tree, trembling in every bough. "And then? What happened then?"

"Oh, we saw no more! That was beautiful, beautiful beyond compare!"

"I wish I might be so fortunate," cried the Fir-tree with delight. "This is far better than sailing over the

sea. How I long for Christmas to come!"

"Rejoice in our love!" said the Air and the Sunshine. "Rejoice in thy youth and thy freedom!"

But rejoice he would not. He grew and grew, in winter as in summer; he stood there clothed in green, dark-green foliage; the people that saw him said, "That is a beautiful tree!" and, next Christmas, he was the first that was felled. The axe struck sharply through the wood, the Tree fell to the earth with a heavy thud; he suffered an agony, a faintness that he had never expected; he quite forgot to think of his good fortune, he felt such sorrow at being compelled to leave his home; he knew that he should never see again those dear old comrades, or the little bushes and flowers that had flourished under his shadow, perhaps not even the birds. Neither did he find the journey by any means pleasant.

When the Tree first came to himself he was in a large room. Pictures hung on the walls, and on the mantelpiece stood large Chinese vases with lions on the lids; there were rocking-chairs, silken sofas, and tables covered with picture-books. The Fir-tree was planted in a large cask filled with sand, and hung with green cloth, and placed upon a carpet woven of many gay colors. Oh, how the Tree trembled! What was to happen next? A young lady, assisted by two children, began to adorn him.

Upon some branches, they hung little nets cut out of colored paper, every net filled with candies; from others, gilded apples and walnuts were suspended, looking just as if they had grown there; and more than a hundred little wax tapers, red, blue, and white, were placed here and there among the boughs. Dolls that looked almost like men and women seemed dancing to and fro among the leaves, and highest, on the summit, was fastened a large star of gold tinsel.

"This evening," they said, "it will be lighted up."

"Would that it were evening!" thought the Tree. "Would that the lights were kindled, for then—what will happen then? Will the trees come out of the forest to see me? Will the sparrows look in through the window-panes?"

At last the candles were lighted, and then, suddenly, both folding doors were flung open, and a troop of children rushed in as if they were going to jump over him; the older people followed more quietly. The little ones stood quite silent, but only for a moment; then their jubilee burst forth, and they shouted with joy till the walls re-echoed.

The children danced and played about with their beautiful playthings, and no one thought any more of the Tree except the old nurse, who came and peeped among the boughs; but it was only to see whether, perchance, a fig or an apple had been left among them.

"A story! A story!" cried the children, pulling an old man towards the Tree.

And then the old man told the story of Humpty Dumpty, who fell downstairs, and yet came to the throne and won the Princess. And the children clapped their hands. The Fir-tree stood, meanwhile, quite silent and thoughtful; the birds in the forest had never related anything like this. "Humpty Dumpty fell downstairs, and yet was raised to the throne and won the Princess!" "Ah, ah! Who knows but I may fall downstairs and win a princess?"

In the morning the maids came in. "Now begins my state anew!" thought the Tree. But they dragged him out of the room, up the stairs, and into an attic-chamber, and there thrust him into a dark corner where not a ray of light could penetrate. "What can be the meaning of this?" thought the Tree. And he leaned against the wall, and thought, and thought. And he had plenty of time for thinking it over, for day after day and night after night passed away, and yet no one ever came into the room. At last somebody did come in, but it was only to push into the corner some old trunks; the Tree was now entirely hidden from sight and apparently entirely forgotten.

"It is now winter," thought the Tree. "The ground is hard and covered with snow; they cannot plant me now, so I am to stay here in shelter till the spring. I only wish it were not so dark and so dreadfully lonely! Oh, how pleasant it was in the forest, when

the snow lay on the ground and the hares scampered about!"

"Squeak! squeak!" cried a little mouse, just then gliding forward. Another followed; they sniffed about the Fir-tree, and then slipped in and out among the branches.

"It is horribly cold!" said the little mice. "Otherwise it is very comfortable here. Don't you think so, you old Fir-tree?"

"I am not old," said the Fir-tree; "there are many who are much older than I am."

"How came you here?" asked the mice, "and what do you know? Tell us about the most delightful place on earth. Have you been into the storeroom, where cheeses lie on the shelves, and bacon hangs from the ceiling, where one can dance over tallow candles, where one goes in thin and comes out fat?"

"I know nothing about that," said the Tree, "but I know the forest, where the sun shines and where the birds sing!" and then he spoke of his youth and its pleasures. The little mice had never heard anything like it; they listened so attentively and said: "Well, to be sure, how much you have seen! How happy you have been!"

"Happy!" repeated the Fir-tree, in surprise; and he thought a moment over all that he had been saying. "Yes, on the whole, those were pleasant times." He then told them about the Christmas Eve when he had been decked out with cakes and candles.

"Oh," cried the little mice, "how happy you have been!"

The next night, the little mice came again and brought with them four other little mice, who also wanted to hear the Tree's history, and the more the Tree spoke of his youth in the forest, the more vividly he remembered it, and said: "Yes, those were pleasant times! But they may come again, they may come again! Humpty Dumpty fell downstairs, and yet, for all that, he won the Princess; perhaps I, too, may win a princess"; and then the Fir-tree thought of a pretty little birch-tree that grew in the forest, a real princess, a very lovely princess was she to the Fir-tree.

"Who is this Humpty Dumpty?" asked the little mice. Whereupon he related the tale; he could remember every word of it perfectly; and the little mice were ready to jump to the top of the Tree for joy.

But, at last, the little mice all scampered away, and the Tree sighed: "It was pleasant when they sat round me, those busy little mice, listening to my words. Now that, too, is all past! However, I shall have pleasure in remembering it, when I am taken away from this place."

But when would that be? One morning, people came and cleared up the attic; the trunks were taken away; the Tree, too, was dragged out of the corner; they threw him on the floor, but a servant picked him up and carried him downstairs.

"Now life begins again!" thought the Tree. He felt the fresh air, the warm sunbeams—he was out in the court. The court joined a garden. Everything was so fresh and blooming, the roses clustered so bright and so fragrant round the trellis-work, the lime-trees were in full blossom.

"I shall live! I shall live!" He was filled with delightful hope; he tried to spread out his branches—but, alas! they were all dried up and yellow. He was thrown down upon a heap of weeds and nettles. The star of gold tinsel that had been left fixed on his crown now sparkled in the sunshine.

Some merry children were playing in the court, the same who, at Christmas-time, had danced round the Tree. One of the youngest saw the gold star, and ran to tear it off.

"Look at it, still fastened to the ugly old Christmas Tree!" cried he, trampling upon the boughs.

And the Tree looked on all the flowers of the garden, and wished from his heart that he had been left to wither alone in the dark corner of the attic. He called to mind his happy forest life, the merry Christmas Eve, and the little mice who had listened so eagerly when he related the story of Humpty Dumpty.

"Past! All past!" said the poor Tree. "Had I but been happy, as I might have been!"

And then the servant came and broke the Tree into small pieces, heaped them all up together, and set fire to them, and the poor Fir-tree was no more.

BLACK DIAMOND

THE LITTLE MARE THAT LIVED DOWN A MINE

SHE was a little black mare, black all over, with just a splash of white hair in the middle of her forehead. She had a black mane, a black tail, and black hoofs; but, because of the white splash on her brow, they called her Diamond.

She lived in Wales and her master was a grain merchant. She pulled his yellow cart with red wheels through green lanes and over mountain roads, carrying sacks of barley-meal from the mill to the shop, and sacks of grain from the shop to the farmers' houses. A great many people knew Diamond, and children in the neighborhood very often played at being Diamond. They would run about with their heads bent down to their chests and their shoulders pressed forward, pulling at the toy reins which the driver held very tightly, while he said, "Whoa, Diamond; steady, Diamond"; and then they would stand still, pretending that they were waiting while the cart was being filled and would toss their heads up and down, just like Diamond.

But one day, one cold, bitter winter's day, poor Diamond slipped on some ice as she came rattling downhill, and fell with a great thud on the road. The beautiful harness, with its red and white brow-band and its shining brass, split like string; the shafts snapped like firewood; the driver was pitched on his head and lay unconscious in the road; poor Diamond, with her knees bleeding and her beautiful soft nose all scratched and dabbled with grit and blood, rolled and kicked and groaned on the hard road, while one of the broken shafts pressed its jagged edges into her heaving flank.

Diamond was so badly injured that it seemed best to put her out to grass.

"She shall have a foal and live light for a couple of years," said the merchant. And Diamond was turned out to pasture. She had lived in this way for two or three months, when her master and a stranger entered the field one day. They had a good look at her, stroked her, felt her legs, ran their hands over her sides, examined her feet, and then walked slowly away talking money.

Diamond wondered what was going to happen. She was not long kept waiting. The very next day the two returned, a bridle was pushed over her ears, a rope was fastened to it, and she was led out of the field. A cart was waiting in the road. The strange man got up in this cart, and took the rope in his hand.

"She's a good mare," said Diamond's master, "and I'm sorry to lose her."

"She'll serve my purpose all right," said the other; and off went the cart with Diamond trotting behind.

They came presently to black and ugly country, with freight cars and engines clanking over lines that stood up from the ground like furrows in a field, and then Diamond saw, in the open air, immense chimneys, and wheels with belting attached to them spinning round and round, and wooden huts, and piles of black coal and great banks of stones, and men with faces like negroes and clothes like chimney-sweeps, going constantly to and fro.

She was taken to what looked like a wooden shed, and there the man in the cart was joined by three or four others, who looked her over, stroked her, and pulled her ears. The men with black faces looked at her as they passed, and one of them called out: "Take your last look at the sun, old girl!" Some of the others laughed; some looked sad and passed on without speaking.

A bandage was tied over the eyes of Diamond. She could see only a dim and obscure light through this heavy covering. Someone patted her. "Come on, old lady," said a voice. She was led forward. She went nervously, feeling her way, and sniffing suspiciously. Someone was patting her side; the man who was leading her stroked her neck. Suddenly her feet struck on wood, instead of the ground, and she started to one side. "Steady, old girl, steady!" said two or three voices. The hand at the bridle pulled steadily forward. Diamond went on a step or two, sniffing and trembling, her flesh twitching with nervousness. "Whoa, there," said the voices. And she stood

still. She heard a heavy door shut behind her, and jumped to one side, crouching down with her hindquarters, her tail pressed between her legs. The man holding her bridle spoke to her and stroked her. Then he called out: "All right. Let her go."

There was a pause; then the noise of a chain sounded, and Diamond felt herself falling through the earth. Down and down she went, and, in her fear, she plunged to this side and that side, blowing great clouds of steam through her trembling nostrils, while a thick sweat broke out from her heaving flanks.

of voices. Someone came forward, took the rope from the man who had brought her down, and led her away.

Diamond felt less frightened when she saw another horse pulling a truck full of coal through one of the tunnels. She felt almost safe when she came to a stable where there were three other horses. The stalls were clean. There was plenty of straw about. The horses were well groomed and looked fat. They neighed a welcome to Diamond, and Diamond answered them.

She was given some oats, but she was afraid of the manger and would not eat.

BLACK DIAMOND TOLD HER BABY ABOUT THE WONDERFUL WORLD ABOVE THE COAL-MINE

"It's all right, Diamond," said the voice of the man; and his hand passed quietly over her neck and under her muzzle. When the bandage was taken off Diamond's eyes, she found herself in a perfectly black world, which was without grass or sky. She could see nothing. She could scarcely breathe. Then, as her eyes got used to this underworld, she saw that the place was a black tunnel, with walls, roof, and floor, and that, in the distance, a light was shining from a lamp.

She was led forward, and soon the light of many lamps fell on her, and she saw men moving, and heard the sound

The man brought some hay for her rack, but she started away from it. Then the man said: "Diamond, my dear lady, a man and a horse can get used to anything. You'll get as used to eating food under ground as above ground, see if you don't." He began to pass a hay-wisp over her, and while he did so he said: "Now, just you listen to me, my pretty. I'm called William—that's the name you'll have to call if you want anything; just you say 'William,' and I'll be round in a second; my name's William, and I've been here for seven and thirty years, and I never yet handled a horse that didn't get to love me.

You've got to love me. I'm going to change your name to begin with, and call you Black Diamond, because you'll be dealing in black diamonds for the rest of your days.

"Now, it's a bit stuffy down here, I admit; and the dark tries the eyes, and you can't help missing the birds, and the trees, and the grass, and the skies, and the rivers, and the sight of children. But, lor' bless you, Black Diamond, we can't all have the best of things. Some must live in palaces, and others in coal-mines. Some must sail ships across the sea, and others must look after poor men in prisons. Some must go fighting, and others must sell shoes. If everybody had everything, there'd very soon be nothing for nobody. And, come to think of it, my lass, you're a deal better off down here with old William than you would be pulling a cab through the streets of London or standing for an hour at a time in the rain outside Cardiff Station.

"Now, isn't that true? Come, taste these oats out of my hand, and see how good they are. You and I are going to be friends; we've got to be friends, Black Diamond. So let's begin at once, and enjoy ourselves."

Black Diamond learned that the love of the miner does make up, in some measure, for the loss of sunlight and heaven's sweet air. She grew to love her friend William. She pulled the coal-trucks through the black mine, and scarcely noticed that she was going gradually, gradually blind. William brought her apples and carrots in his coat-pocket, and the other miners made a pet of her, and she was soon a favorite with the other horses in the stall. "A pit's a poor place to live in," reflected Black Diamond; "but it's wonderful what a little love will do."

She worked faithfully, ate heartily, and slept soundly. But in spite of all this she was going gradually blind.

Then her foal was born, and the miners called it Little Diamond, and Black Diamond grew very happy, telling this black baby all about the wonderful world above the coal mine. She had just sufficient sight to see her baby, and she would lick it for hours, with her poor, fading eyes full of great tears.

"I like to hear your stories," said Little Diamond; "but, of course, I don't believe they're true. They are only fairy stories, aren't they?"

And years afterwards, even Black Diamond herself came to think that the green earth, where she had spent so many delightful days, must be only a dream.

It is so difficult, when one is born in the dark, and lives in the dark, to believe that just a little way above there is a world bathed in light and sunshine.

IDUNA AND THE GOLDEN APPLES

In the ancient days, the English people lived in a country between Denmark and Germany. They were then a fierce race of heathen warriors and seafarers. They loved the noise of battle and the hazards of adventure, and they worshipped savage deities of thunder and war. But though they were rough and wild, and scorned the arts of peace, they loved to hear songs about brave men and beautiful women, and this side of their character is shown in the stories they used to tell about Bragi and Iduna and the golden apples.

Bragi, the tall and comely god of poetry, dwelt with other gods in Asgard, a land of eternal spring, that shone with its golden battlements far up in the sunlit sky. Bragi had a harp with golden strings. When he took it in his hands, and began to sing to the music he made, all the gods put everything aside, and listened with delight to him. His voice was very sweet, and nobody could resist it.

Sometimes Bragi would come down from Asgard and wander about the earth. One day he sailed to an island where all the air was sweet with the flowers of spring. There he sang of the joy of life and the power of love; and, as he sang, a maiden, crowned with blossoms and leaves, rose up before him, among the flowering grasses and the budding bushes.

She was Iduna, the spirit of eternal youth, fair as the daybreak and pure as running water. She guarded the enchanted tree on which grew the golden apples of immortality.

When Bragi saw her, he sang with such joy that the sound of his voice filled the nine worlds. Then he stretched out his arms to Iduna and she came to him.

After they were married, they went to Asgard. The gods welcomed Iduna with joy, and she gave them some of her apples to eat, and they were filled with the gladness of immortal youth. Unhappily, an old and ugly giant, living in the bleak and wintry land of Thunder, heard of the arrival of Iduna at Asgard, and resolved to obtain one of her apples, so that he might eat it, and become young and beautiful. He seized one of the gods, Loki, who came near his domain, and held him a prisoner until he promised to bring Iduna to him. Loki returned to Asgard, and found Iduna alone, Bragi having gone off alone on a long journey.

"Come with me, Iduna, out of Asgard gate, and I will show you a tree that bears golden fruit resembling your wonderful apples," said Loki.

Iduna followed him, and Loki led her to the giant, who carried her off to the land of Thunder. For some time the other gods thought Iduna had gone on a journey with Bragi. But time passed, and their hair began to turn grey, and their faces to grow white and withered, because they had no apples of immortality to eat. Then they began to search for her, and found that she was last seen walking out of the gate with Loki, and the traitor confessed, but promised to bring her back if he were given a pair of wings.

His request was granted. Swiftly he flew to the land of Thunder, and there he found Iduna sitting in a bare hut very sad and lonely. Happily, the giant was away. But just as Loki began to carry Iduna back to Asgard, the monster appeared. He was very, very angry, for he had not succeeded in persuading Iduna to give him one of her apples, and, putting on an eagle's dress, he rushed after the fugitives like a storm.

IDUNA GAVE THE GODS SOME OF HER GOLDEN APPLES AND THEY RECOVERED THEIR YOUTH

This picture is reproduced from the painting by J. Doyle Penrose, with the artist's permission.

All the gods stood on the battlements of Asgard, anxiously watching the chase. Loki came along at a marvelous speed, but, as he neared the gate, the giant sprang upon him. He sprang too late, however, for the other gods came to the rescue, and slew him.

Iduna gave them all some of her apples, and they recovered their beauty and their youth; and soon afterwards Bragi returned, and sang a song of triumph, and all the gods were pleased.

THE NEXT STORIES ARE ON PAGE 3705.

THE PAINTED DESERT

This is a picture of the petrified forest. In the background here and there can be seen fragments of the great stone tree trunks lying prostrate on the sand. These tree trunks have been lying here for nobody knows how many centuries since they were cast up from the bottom of the great American inland sea of long ago. The picture on the opposite page gives an idea of what the trunks look like.

In the distance against the beautiful sky of the Arizona desert we see the peculiar terraced houses of a Pueblo Indian village built high upon a rocky, sandy mesa. These houses are built one upon another, each story one step back from the lower story, thus affording a shelf which is used as a courtyard and children's playground. Some of the people are now forsaking the houses to live on the plain below.

LOGS OF PETRIFIED WOOD IN THE PAINTED DESERT

AN AMERICAN DESERT AND ITS INHABITANTS

CONTINUED FROM 3495

THE call of the Wilderness—all who have been within the borders of the Painted Desert region have felt it—and yet,—what is it? To the Spaniards this region was the *arida zona,*—the arid zone. To the American pioneers who first penetrated its wastes, it was a land of terror, part of the dreaded Colorado Desert, which separated them from the land of promise in the West. To us, it is a place of mysterious beauty; to which, if once we have seen it, we are called back by its haunting charm.

The whole state of Arizona is in the arid zone, and much of the land is dry, for its rivers have cut down so deep through the sandy soil, and soft rock, that they give the thirsty land no water. Yet there are fertile valleys and forest-covered mountains. The desert herbage gives food to thousands of cattle, and large flocks of sheep. Where springs of water can be reached, or irrigation works have been built, sandy wastes have been turned into fruitful fields and gardens. The whole country is full of wonderful light and color, and nowhere is the light clearer, or the colors more brilliant than in the northern region of mesa and cañon called the Painted Desert.

At first, the desert seems but a vast, dreary wilderness of barren sand and sky—"a land of lost rivers with little in it to love." It is a land full of dangers—danger of sunstroke from the scorching heat of the midday sun, of chill from the sudden cool of the nights,—danger of parching thirst, of fierce thunderstorms and of blinding sand-storms. Before us lie mile upon mile of inhospitable sandy wilderness and blunt, sun-scorched hills painted bright with glaring red and brown and blue, purple, yellow and white. The sky stretches above, cloudless and intensely blue; the air is filled with the glare of the sun until the landscape swims before us in waves of quivering color. Here and there the waste is broken with patches of mesquite, of creosote, of sage-brush and of huge cacti, sometimes fifty feet tall, and queer, tricksy, ground creatures slink across the open spaces. Yonder a little bright lizard lies on the sand and pants and enjoys the sun. The painted lizard and the deadly desert rattlesnake, called the side-winder because of its sidelong motion, alone of all the desert creatures seem to seek the torrid heat of the sunny places.

In the summer the heat is often 125 degrees in the shade. A piece of metal that has been lying in the sun cannot be touched by the bare hand, for it would raise blisters.

Yet the air is so dry that the heat is not often unbearable, and the nights in the open air of this healthful region are generally cool. The greatest drawback to the country is its lack of shade and it is said that cattle will seek the shade of a tall cactus plant, or even a telegraph pole in an effort to escape the sun's glare.

THINGS IN THE DESERT ARE NOT WHAT THEY SEEM

It is unwise for people who are strangers to the desert to attempt expeditions on foot. In the clear dry air, distances are very deceptive and people on foot wander further than they realize, and become lost in the desert for days at a time.

The land is not dead like the Sahara; but there is little water to be found throughout this great region. The rivers have cut deep trenches through sandy soil and soft rock, and the Colorado flows at such a depth that the faintest murmur of its thunder cannot reach its lofty banks, and men have died of thirst within sight of its rushing waters, and even the railways must provide great tanks of water for their engines. Every puff of wind whirls a cloud of alkaline dust along the plain, to fill the nostrils and blind the eyes of the unwary traveler.

In the violent tornado-like sand-storms which sometimes overtake travelers in the Painted Desert, people are very apt to be smothered or buried in the sand. The only hope of safety lies in tightly wrapping one's head in a blanket and keeping quite still until the storm is over. In these terrible sand-storms whole sand hills are sometimes torn out of the earth and whirled across the country. As some one said, if you would buy land in Arizona, you must see that it is safely anchored or you will wake up one morning to find that it has been transported into the next county.

THE SAND-STORMS AND THEIR DANGERS TO TRAVELERS

Quite a number of people are lost in these sand-storms each year, and their flesh becomes food for the carrion birds that are always hovering somewhere in sight in this desert land. Wherever death overtakes a man or beast, these birds may be found, slowly circling lower and lower—waiting to swoop down hungrily the first moment the breath is out of the body.

But dust-storms are not the only storms to be met with. Heavy thunder-storms are not infrequent, and the air is so clear, and the country so open that they may be seen many miles away.

It is said that when a Navajo herdsman sees a heavy thunder-storm twenty or thirty miles away he immediately sets out for the part of the country over which it has passed. He knows that his thirsty cattle will find pools of water there, and that the tender grass and herbs which spring up quickly in its path will give them food to eat.

THE CHANGE THAT FOLLOWS THE COMING OF THE RAINS

Though the desert takes its toll of men, it has a wild elusive lotus charm. The sun-scorched hills are luminous and rainbow-tinted in the morning mists; the wilderness has its bits of tender green where silver threads of springs bubble up and flow out into the desert to be gulped down by the thirsty sands. True, —it is a land of arid wastes,—yet a single spring shower in a night will make the "desert blossom like a rose," and people wake to find stretches of tender grassy blades where before had been only sand—and in the grass are a multitude of blossoms—pink, pale blue, crimson and palest gold. We live a week or two in the desert which seems so fierce and relentless,— and behold,—the tender witchery of the land holds us fast and when we go away it is not of the waste we think,—of the thirst, of the storms, of blinding sand and of drenching rain; but we remember the rainbow hills in the bluish morning mist, the glorious colors painted lavishly on hill and sand by Nature's Master Painter, the desert air after a storm has swept it clean—cool and crisp and intoxicatingly sweet—"the divinest air to be breathed anywhere in God's world." This is the call of the desert, and once it has been heard, it draws men back. Miners and cattlemen feel the charm alike, and though they leave it, cursing the land for its dryness and its heat, they all go back.

A FOREST OF SOLID STONE

In one part of the Arizona desert, we come to the petrified forest—which is a

part of the fascination of this strange wild land. On every side lying about us are great stone trunks—pine trees of agate, and of chalcedony. At our feet lie thousands of chips of amethyst, of red agate, of smoky topaz, and of opal.

The story of these trees of agate and of chalcedony is but another wonder tale of the fairyland of the desert. Long, long ago, ages before man appeared on the earth, a great forest covered the plain near where these trunks now lie. Then the land on which they grew sank down; the sea rushed in and covered the forest; century after century the forest lay at the bottom of a sea which was full of mineral salts that caused the decaying logs to become petrified. Torrents and turbulent rivers rushing down to the sea carried in their waters quantities of sand, which sank to the bottom. Gradually it covered up the stony trunks, and formed a heavy blanket far above their heads. After a long, long time the bottom of the sea was again heaved up, until it was raised thousands of feet above its ancient level, and became a dry plain, the Painted Desert that we know. Thousands of years again went by. The land lay in the bright sunshine as it does to-day; but the rain of summer, the cold of winter, the winds and the torrents were constantly at work. They carved out the deep valleys that we call cañons, and left the high table lands that we call mesas. The trunks of the ancient trees were torn from the resting place where they had lain so long, and swept by the force of torrents to the place where they were found. One of these trees still lies across a narrow cañon, and forms a wonderful natural bridge.

THE DWELLERS IN THIS DESERT LAND

The people who live in this wonderful desert are as mysterious as the land itself. Men ask whether they have come from the north or from the south, from the coast of Asia or some far Pacific island. No one can answer. Their origin remains uncertain, and their history is unknown, except through legends and traditional songs and mystic ceremonies handed down from father to son through long generations.

We travel into the desert region to visit this ancient race, whose terraced villages, built upon dry, desolate plateaus called mesas, are the same to-day as they have been for many hundreds of years. The centuries have made but little change in this wild land and its peoples; we find that "the worn trails to the mesa summit are the same; the glaring yellow sand is the same; the red and gray rocks are the same; the glaring, pitiless sun with its infernal scorching is the same." Above in the villages we find naked children, lithe active young men, young women, with their peculiar style of hairdressing, blear-eyed old men and women, patient and stolid burros, and dim-eyed captive eagles. The quaint terraced houses with their peculiar ladders, grotesque chimneys, passageways and little steps are all practically the same as they have been for centuries.

THE STRANGE PEOPLE CALLED CLIFF DWELLERS

Long, long ago—so long that no man can remember—a race of strange people built houses among the cliffs of Arizona, New Mexico and Colorado. They are commonly known as the Cave and Cliff Dwellers, but no one knows who they were nor whence they came. Ruins of their cliff houses can be seen to-day, and in another part of our book we have given a picture of some of these ruins. It is from this strange, ancient race that the Hopi Indians of the Arizona Desert are descended. Although naturally peaceable they were forced to turn their homes into fortresses and so they chose to build upon rocky hills or mesas for purposes of protection. "With but one or two almost inaccessible trails reaching the heights, their homes were easily defendable. Their fields, gardens and hunting-grounds were in the valleys or far-away mountains, whither they could go in times of peace, but when attacked by foes, they fled up the trails, established elaborate methods of defence, and remained in their fortress homes until the danger was past. The very construction of the houses shows this. In none of the houses is there any doorway into the lowest story. One climbs up a ladder outside, drops through a hole in the roof, and descends the ladder inside. When attacked, the outer ladder could be drawn up."

The hot desert sun beats down upon us pitilessly as we toil up the steep trail that winds to the summit of one of the mesas. As we reach the head of the trail, the picturesque village of terraced houses

stands before us. The terraces are built two or three stories high, each story being set back from the one below, thus giving a part of the roof of the lower story to be used as a courtyard or playground for the children.

You will be astonished to learn that the Hopi houses are owned and built by the women. Indeed the position of a Pueblo Indian woman is very high. She owns the house and receives her husband into her home. The children take their clan name from their mother and not their father; the "corn, melons, squash, and other vegetables belong to her when once deposited in her house by her husband. She is, indeed, queen in her own home, and is on quite equal terms with her husband."

THE INTERESTING CHILDREN OF THESE STRANGE PEOPLE

These brown youngsters are a very important factor in the Hopi community. When the cornfields at the foot of the mesa are ripe the younger boys and girls scare away the birds or other marauders from the precious harvest that has been wrung with so much labor from the sandy, sun-scorched soil. And when the harvest is ready to be gathered, the little children, as well as the women, aid the men in gathering the crops, in steaming the corn in a great oven dug in the ground, and in packing the ears in sacks and blankets on the backs of the little donkeys, called burros, to be carried to the corn rooms on the mesa above. "All the young boys, even the little tots who can scarcely walk, use the bow and arrow with dexterity." We bribe the children to come forth from their hiding places by showing some pennies, and then borrowing a small hard melon from one of the kindly, wrinkled Indian women, we begin a shooting match. The melon is thrown into the air and the children shoot their arrows at it to see how many they can stick in it before it reaches the ground. One small chap manages to get three arrows in the melon.

But the children are not the only interesting members of this race. The group of girls in their picturesque blanket robes with their shining black hair twisted wheel-like over each ear are a very pleasant sight to look upon. Every Pueblo Indian girl, as soon as she is of marriageable age, twists up her hair so over her ears to symbolize the blossom of the squash. When she marries she parts her hair and wears it in doubled up braids one on each side of her head to symbolize the fully developed squash fruit.

The Hopis are wonderfully hospitable and presently we are invited to climb up one of the ladders and to descend into the house. As we squat upon the floor, the Hopi housewife places a big basket of flat yellow cakes called piki before us and signifies that we are to help ourselves. We do and find that the little cakes are not half bad.

COOKING THE FOOD CALLED PIKI ON THE STONES

"It is fascinating in the extreme to see a woman make piki," says George Wharton James. "Dry corn-meal is mixed with coloring matter and water, and thus converted into a soft batter. A large, flat stone is so placed on stones that a fire can be kept continually burning underneath it. As soon as the slab is as hot as an iron must be to iron starched clothes it is greased with mutton tallow. Then with fingers dipped in the batter the woman dexterously and rapidly sweeps them over the surface of the hot stone. Almost as quickly as the batter touches, it is cooked; so to cover the whole stone and yet make even and smooth piki requires skill. It looks so easy that I have known many white women and (men) tempted into trying to make it. Once while attending the Snake Dance ceremonials at Mashonganavi, a young lady member of my party was sure she could perform the operation successfully. My Hopi friend, Kuchyeampsi, gladly gave place to the white lady, and laughingly looked at me as the latter dipped her fingers into the batter, swept them over the stone, gave a suppressed exclamation of pain, tried again, and then hastily rose with three fingers well blistered."

Although the Hopi woman, who has been grinding corn in a big trough while we have been eating the piki and has been talking to us by signs, is very interesting, yet we are glad to ascend the ladder and to get once more into the open air, for the ancient Hopi houses, though picturesque, are not the most wholesome places in the world. Some of these Hopi Indians are now leaving their ancient towns to live on the plains below.

THE NEXT STORY OF THE UNITED STATES IS ON PAGE 3751.

INDIANS OF THE DESERT

We know that this is the picture of an unmarried Pueblo girl by the way in which she arranges her hair in two whorls to symbolize squash blossoms. Notice her ornament of beaten silver.

This is a young Pueblo matron, as we may see from the arrangement of her hair in two rolls, to signify the ripe fruit of the squash. This symbolism of flower and fruit is very pretty.

The Pueblo mother carries her papoose on her back. This picture gives a good idea of the blanket robe of the Hopi woman, which folds over one shoulder, leaving the other bare. These people are very intelligent.

The burning sun and the struggle for existence in the desert make its inhabitants grow old early. Here is the picture of a Hopi in middle life, who from his face might be an old man. Perhaps he has beaten his earrings from a silver dollar.

AT THE INN AND IN THE STOCKADE

The rough old sailor, Bill Bones, appeared one day at the Admiral Benbow Inn, and remained there. He spent his time watching for a ship and drinking rum. It turned out later that he had been a member of the crew of Captain Flint, a famous pirate, and had possession of a map which showed where treasure had been hidden. When drunk he was noisy and quarrelsome and was likely to threaten all around him.

After Bill Bones' death, Jim Hawkins secured the map, and Doctor Livesey and Squire Trelawney fitted out a ship to get the treasure. The Squire talked too much and some of Flint's old crew learned of the expedition and engaged themselves as sailors. When they reached the island they mutinied, and attacked the Doctor, the Squire and all the loyal members of the expedition, who took refuge in Flint's stockade.

WHAT THIS STORY TELLS US

"TREASURE ISLAND" is a boy's tale of adventure, written for boys, with a boy for a hero. Many grown-ups as well as boys and girls read and re-read the story. The story grew out of a map which Robert Louis Stevenson drew and colored one day to entertain his little stepson, Lloyd Osbourne. On the map he marked names at random, and then built a story around this chart. The chart of the island is given as the frontispiece of the book, but its whereabouts in the sea is not mentioned. The story was first published in 1881 as "The Sea-Cook," and appeared in "Young Folks," a boy's magazine. In 1883 it came out in book form, and has now been made into a play. The pictures show some scenes from the play. Long John Silver is the villain of the story

TREASURE ISLAND

CONTINUED FROM 3522

"FIFTEEN men on the Dead Man's Chest—
Yo-ho-ho, and a bottle of rum!
Drink and the devil had done for the rest—
Yo-ho-ho, and a bottle of rum!"

A rugged old seaman, with a sabre-cut on his cheek, sang his favorite song again and again, and the Admiral Benbow Inn, in a little English village, echoed and re-echoed with the chorus. When he was not out upon the cliffs, scanning the sea with his brass telescope, he was sitting in the corner of the parlor near the fire. Sometimes he called for his rum, and when Jim Hawkins, the innkeeper's son, brought it to him, he sang his old wild sea-songs in his high, quavering voice.

"Jim, my lad," he said one day, taking the boy into his confidence, "keep your weather-eye open for a seafaring man with one leg." Then he told Jim thrilling tales of storms at sea, and of the wild deeds on the Spanish Main. Especially he spoke of Captain Flint, a pirate.

Week after week the old captain had been at the inn, but had paid nothing. When Jim's father suggested that he should pay his bill, the old man blew through his nose so loudly that every one fled from the room. The sea-chest in his room was kept locked, and the captain always wore the same cocked hat and patched blue coat, and his tarry pigtail fell over his shoulder.

"Fifteen men on the Dead Man's Chest," shouted the captain one evening, and brought his hand down on the table with a bang. "Silence, there, between decks!" All voices stopped at once, all but Dr. Livesey's, who went on talking as before.

"Were you addressing me, sir?" said the doctor. "Let me say that if you keep on drinking rum, the world will soon be rid of a very dirty scoundrel!"

Enraged, the captain sprang to his feet and rushed toward the doctor with open knife. The doctor never moved, but calmly said:

"If you do not put that knife away instantly, I promise, upon my honor, you shall hang at the next assizes."

Grumbling like a beaten dog, the captain put up his weapon, and resumed his seat.

"I'm not a doctor only; I'm a magistrate, and if I catch a word of complaint against you, "I'll have you hunted down and routed out of this. Let that suffice." Dr. Livesey rode away shortly after that, and the captain held his peace that evening, and for some time after.

Not long after this, one frosty January morning, while the captain was on the beach gazing through his spy-glass, the door of the inn opened and there entered a tall, gaunt man with two fingers missing on one hand.

"Come here, sonny," he called to Jim. "Is this here table for my mate Bill? He has a cut on one cheek, and a mighty pleasant way with him, particularly in drink, has my mate Bill."

"The captain has gone out walking," Jim replied.

The stranger hung about just inside the door, peering round the corner like a cat waiting for a mouse. Soon the stranger spied the captain approaching, and he made Jim hide with him, and when old Bill entered he addressed him:

"Bill, you know your old ship-mate, surely."

"Black Dog!" gasped the captain.

"Black Dog as ever was," returned the other.

For some time Jim, in the next room, heard low voices, and then loud noises, and all of a sudden an explosion of oaths, a clash of steel, and a cry of pain. Peering into the room, he saw a flourish of cutlasses, and the next minute Black Dog dashed down the road.

The old captain stood staring after him, and then returned to the table and called for his rum. "Jim, Jim," he called, reeling as he spoke, and fell full length on the floor.

Just then the door opened, and Dr. Livesey came in, on his visit to Jim's father, who was ill.

"Oh, doctor," cried Jim, "the captain's wounded!"

"No more wounded than you. He's had a stroke, as I warned him."

When the captain opened his eyes and looked mistily about him, his first question was, "Where's Black Dog?"

"There is no Black Dog here," the doctor assured him. "You've been drinking and have had a stroke." The doctor helped him to bed, and advised him to remain there for a week at least.

"Thunder!" he cried. "A week! I can't do that; they'd have the black spot on me by then. But I'm not afraid of them, and I'll trick 'em again." He lay silent for a while, then said, "Jim, you saw Black Dog to-day? Well, he's a bad 'un, but there's worse that put him on. They're after my old sea-chest. If they tip me the black spot,—that's a summons, mate,—you get on a horse and ride to the doctor and tell the magistrates to get old Flint's crew."

For several days, the captain seemed weak, but he drank more rum than ever, and when drunk had an alarming way of drawing his cutlass, and laying it before him on the table.

One bitter afternoon, as Jim was standing at the door of the inn, a blind man wearing a green shade over his eyes, and a huge, old, hooded sea-coat that made him look deformed, approached. He stopped near the inn, and addressed the air: "Will any kind friend inform a blind man where or in what part of the country he may now be?"

"You are at the Admiral Benbow," said Jim.

"Give me your hand," hissed the blind man as he gripped the lad. "Now, boy, lead me to the captain, and take me straight, or I'll break your arm."

Terrified, Jim led him to the captain, who was half asleep. "Now, boy, take the captain's left hand by the wrist, and bring it near my right."

The blind man dropped something in the captain's hand, and then hastened away, and they heard his stick go tap-tapping into the distance.

"You have till ten to-night," read the captain. "Ten o'clock!" he shrieked, and sprang to his feet, but then reeled and fell with a heavy thud to the floor. Jim called his mother, but nothing could be done for the captain—he was dead.

Jim and his mother rushed to the village for assistance, but no one would venture to the inn, for the name of Captain Flint filled them all with terror. However, they gave Jim a loaded pistol, and offered to go for armed assistance. Alone, the two returned to the inn, and ventured into the parlor, where lay the body of the dead captain. There on the floor near his head was a piece of paper with a black spot, and around his neck hung the key to his treasure-box.

Snatching the key, Jim hurried to the box, opened it, and found on top trinkets, pistols, and sticks of tobacco, and underneath a canvas bag filled with gold, and a bundle tied up in oilcloth. His mother snatched up the bag and took from it the amount the captain owed her. "I'll have my dues, and not a farthing over," she said. "And I'll take this to square the count," said Jim, picking up the oilskin packet and concealing it in his breast. Frightened by footsteps in the distance, they hastened away from the house, but remained within earshot of the inn.

Breathless with fear, Jim and his

mother saw a group of eight men, led by a man with a lantern, dash into the house. They heard them running to and fro, overturning the chairs and tables in their search. There was a cry of surprise, "Bill's dead!" Another voice called, "Search him, you shirking lubbers, and get the chest."

"Some one has searched the chest," roared one of the buccaneers.

"It's that boy," cried Pew, the blind man; "rout the house out!"

They scattered to search, but at the sound of a pistol-shot, evidently a signal, all the pirates rushed away. Only old Pew was left behind, begging them to save him, and as he turned, bewildered, some horsemen bore down upon him. He was struck by the flying hoofs, and moved no more. The riders proved to be revenue officers. They went to the house and perceived the result of the pirates' search.

Jim rode to tell Dr. Livesey the news. "Bravo!" said the doctor as Jim handed him the oilskin packet, containing a map and other clues to Flint's treasure, which was buried somewhere on an island far away.

The doctor, Squire Trelawney and Jim studied the map of the island found in the packet. It showed three crosses, and beside one was written, "Bulk of treasure here."

"We'll fit out a ship, and Jim and the doctor shall go, but not a word of our scheme to any one. We'll soon be rolling in wealth."

Ready for the voyage to Treasure Island, the Hispaniola stood at the dock. Long John Silver, an old one-legged sailor, had offered to provide the crew. In a few days Silver got together a company of the toughest salts imaginable. Jim was wild with delight at the prospect of going to sea,—going with a piping boatswain and singing seamen,—going forth to seek buried treasures on an unknown island.

Waiting at the tavern for the ship to sail, Jim chanced to see Long John, and decided that he was the one-legged sailor whom he had been told to watch for at the old Benbow. There also he noticed "Black Dog," the man with two fingers missing, who had visited the inn. Silver pretended not to know that Black Dog and Pew, the blind man, had been buccaneers. Jim was suspicious, but he was soon lost in admiration of Long John and his parrot, as the sailor told him stories of ships and seamen and taught him nautical phrases.

All hands were on the dock waiting for the sailing. The captain and the squire stepped aside and held a whispered conversation. "Captain Smollett," remarked the squire, "all well, I hope, all shipshape and seaworthy?"

"Well, sir," said the captain, "I don't like the crew. I'm suspicious, for every man before the mast knows more than I do. I hear we're going after treasure. Treasure is ticklish work, and I don't like treasure voyages that are secret. The secret has been told to Silver's parrot."

"I hear" he continued, "that the crew knows that you have a map marked with crosses to show where the treasure is."

"I fear trouble, for I never told that to a soul," cried the squire.

"Ready, mates, we're off," cried Long John, and then, after great bustling and commotion, they pulled up the anchor as the crew sang the words: "Fifteen men on the Dead Man's Chest."

Jim with a shiver recalled the voice of the captain at the Admiral Benbow, who used to sing again and again that same refrain.

Long John Silver, in spite of his crutch, commanded respect from all the sailors. With his parrot, Captain Flint, perched on his shoulder, he would jump along on his crutch as nimbly as any other man could walk. "Ah, she's a handsome craft, she is," Silver would say as he fed her sugar from his pocket. "Pieces of eight! Pieces of eight!" screeched the parrot in reply.

Every man on board worked well, and all was quiet until the last day of the outward voyage. That evening at sundown, Jim went to get an apple from a big barrel on the deck. He heard voices talking in excited fashion, and jumped quickly inside the barrel to hear without being seen.

Hidden in the barrel, Jim heard Silver telling the story.

"Flint was cap'n," said Silver, "and I was quartermaster, along of my timber leg. The same broadside I lost my leg, old Pew lost his deadlights. There was some that was feared of Pew, and some that was feared of Flint, but Flint his own self was feared of me. Now here we are in this voyage. Cap'n Smollett, a first-rate seaman, sails the blessed ship for us. But the squire and doctor has a map. I

don't know where it is, do I? No more do you, says you. We must get it, then make a search for the treasure, make the cap'n navigate us half-way back again, and then we'll strike. We might put the men ashore, or cut 'em down like that much pork. That would have been Flint's way or Billy Bones's."

"Billy was the man for that," said Israel, one of the sailors.

"Right you are," said Silver, "rough and ready. This time is serious, and dooty is dooty, mates. I give my vote—death. Wait is what I say, but when the time comes, why, let her rip!"

"John," cried the coxswain, "you're a man!"

"Only one thing I claim," said Silver. "I claim Trelawney, and I'll wring his head off. Say, Dick," he added, breaking off, "you just jump up like a sweet lad, and get me an apple."

Jim, in his hiding-place in the apple barrel, was terrified. Fortunately for him, Silver changed his mind and told Dick to bring the rum instead. Dick returned with the rum, and one after another they drank—one "To luck," and another "To Flint," and then Silver said, "Here's to ourselves, and hold your huff, plenty of prizes and plenty of duff." Just then the voice of the lookout shouted "Land-ho!" and there was a great rush of feet across the deck, and the sailors hurried away.

Jim rushed from his hiding-place as all hands came on deck. Captain Smollett was issuing orders to anchor on the south side of the island. He showed Long John a chart, a copy of the original found in Billy Bones's chest, complete in all details, with the single exception of the red crosses and the written notes. Long John's eyes burned as he took the chart, but he was doomed to disappointment.

"Yes, sir," said he, "this is the spot, to be sure; and very prettily drawed out."

In the meantime Jim had secretly told the squire and the doctor the details of Silver's conversation. "I fear we may have to come to blows sooner or later," said the squire, "but we'll keep a sharp lookout. Jim, keep your eyes and ears open, for there are nineteen men of the crew against us."

The next morning the Hispaniola was anchored, and orders were given to lower the boats. The crew began to growl over the work. Fearing serious trouble, the captain decided to let the men go ashore in the boats. So Silver and thirteen of the crew embarked. With a loud cheer they took to the boats, thinking to get at the treasure before the others could locate it.

Jim foolishly slipped over the side of the ship and concealed himself in the nearest boat. The crews raced for the beach, and when the boat Jim was in reached the shore, he jumped out and plunged into the nearest thicket. Silver spied him, and shouted after the lad, but he only hurried on and ducked out of sight.

On and on Jim sped, across a marshy tract, over a sandy stretch, and then came to the borders of a fen. The island seemed to be uninhabited except for wild animals and birds. Suddenly Jim heard a bustle among the bulrushes and recognized Silver's voice, and made out that Silver was trying to persuade one of the honest hands to mutiny. Upon his refusal, Silver whipped the crutch out of his armpit, and hurled it at the sailor, knocking him down. Then, agile as a monkey, Silver jumped at the fallen man and killed him.

Jim crouched down in the grass and saw Silver pick up his crutch, and heard him blow a whistle which summoned the desperadoes. In mortal fear, Jim dashed out of the thicket, and ran in the direction of the boat and away from the murderers. As he sped along, he heard a sound, and turning, saw a shaggy, dark figure leap behind the trunk of a pine. In terror of this new apparition, he pulled out his pistol, and the wild figure hesitated, then fell on his knees and held out his clasped hands in supplication.

"Who are you?" asked Jim.

"I'm Ben Gunn," he replied in a hoarse voice, "and I have not spoke with a Christian these three years." The sunburned old fellow was clothed with tatters of old ship's canvas held together with crude fastenings, and a leather belt.

"I was left marooned," he continued, in a plaintive voice, "and I've lived on goats and berries ever since, and I'm so hungry for real food!" He told of his experiences, and Jim told him the whole story of their adventures on the voyage, and what he had seen on the island.

"Jim, if your squire would come down to the 'toon' of one thousand pounds and a passage home, I'll tell you a secret."

"Agreed. Well, I was in Flint's ship

when he buried the treasure. Billy Bones was mate; Long John was quartermaster. Later I landed here in another ship in search for the treasure, and was left marooned here. There's my story. Now, lad, go back to your squire. If you see Silver, dont' tell him you saw Ben Gunn."

Meantime the doctor and the squire learned that Jim had gone ashore with the rest. So they hastened to provision a boat and went ashore in quest of information. Leaving one man with a loaded pistol to guard the six sailors on the ship, the others made for the stockade which had been erected by Flint and his party. When they had entered the fort, they saw seven of the mutineers coming toward them. The squire and the doctor fired, and in return ball after ball whistled around them.

"Where do you suppose Jim is?" said the doctor. Just then some one pounded at the door, and shouted, "Doctor! Squire! Captain! Let me in! It's Jim!"

Then Jim rushed breathless into the stockade, and told his friends how he met Ben Gunn, and how he and Ben were interrupted in their talking by the shots. Ben disappeared in one direction, and Jim rushed down to the shore, where he saw the ship still at anchor, but flying the black flag of piracy. Then cautiously he had crept to the stockade.

All hands were called up before the captain, and he divided them into watches for the night. So for weary hours, in the damp and dreary stockade, they took turns in guarding the fort.

Next morning there was a great bustle outside, and then a figure appeared on the wall, waving a white cloth, and shouting: "Flag of truce!"

"Who goes? Stand, or we fire," said the captain.

"Silver, it is, sir,—ready to make terms." Then he advanced to the stockade, jumped nimbly to the fence, threw his crutch over, and dropped safely to the other side. "That was a good lay of yours last night," continued Silver, "and we was shook; maybe I was shook myself; maybe that's why I'm here for terms. But you mark me, cap'n, it won't do twice, by thunder!"

"Well?" said Captain Smollett coolly.

"We want that treasure," exclaimed Silver hotly, "and we'll have it. You want your lives, I reckon, so you give us the chart to get the treasure. Now, here's a choice. You come aboard along of us, once the treasure is shipped, and then I'll give you my affy-devy to clap you somewhere safe ashore. But if it's more to your fancy, some of my hands being rough, you can stay here, and I'll send a ship back to pick you up. Refuse that, and you've seen the last of me but musket-balls."

"Very good," said the captain. "You can't find the treasure, and you can't sail the ship,—your men are not fit for that,—nor can you fight us. So tramp, my lad, and double quick."

"Before an hour's out, I'll stove in your blockhouse like a rum-puncheon. Then you'll laugh, by thunder, but on the other side. Them that die'll be the lucky ones." Grumbling to himself, Silver stumbled off and disappeared among the trees. As soon as he was out of sight, the captain ordered all hands back to their places to stand guard with loaded muskets. In a short time, a report was heard in the distance, followed by shot after shot. Several bullets struck the stockade. A volley of shots was returned from the fort. Then suddenly, with a loud huzza, the pirates leaped from the woods, and swarmed at the fence like monkeys.

"Out, lads, and fight 'em in the open! Cutlasses!" ordered the captain.

A hand-to-hand encounter resulted in victory for the holders of the stockade. Five of the pirates were killed. The captain and others of the faithful party were badly wounded. The buccaneers retreated. There was no return of the mutineers,—not even a shot out of the woods was heard. So, after a short time, the doctor took up his hat and pistols, snatched up a cutlass, and dared to venture forth, hoping to find Ben Gunn.

While nobody was watching, Jim took a brace of pistols, filled his pockets with biscuits, and made a bolt over the stockade and into the thickets in the direction of the sea, where Ben Gunn said he had left his boat.

As he crept cautiously along the shore, he spied the Hispaniola still at anchor. As it was growing dark, Jim hastened along, eager to locate Gunn's boat. Finally he found it in a hollow, hidden by the banks and thicket. It was a rude, home-made little coracle, and Jim took a great fancy to it. Impulsively he shouldered it, and groped his way through the swamp under cover of darkness, waded

out into the water, and set the coracle on the surface. Jim paddled toward the Hispaniola, finding her with difficulty in the darkness. When he neared it, he grasped the hawser with one hand, opened his knife with his teeth, and cut one strand after another.

The schooner began to turn upon her heel, spinning slowly across the current. A light rope was trailing overboard across the stern bulwarks. Hardly knowing what he was doing, Jim reached over the side of his little boat, grasped the rope, and pulled himself up the rope into the big ship, and dropped upon the deck.

One glance in the cabin showed two drunken figures locked together in a deadly wrestle, each with a hand upon the other's throat. Suddenly the schooner lurched, and the fighters, interrupted in their quarrel, realized their danger. For a time Jim looked around the ship, then he returned to the little coracle. Tired out with the excitement of the day, Jim fell down in the bottom of the skiff, asleep.

In the morning Jim paddled the coracle near the ship and climbed aboard, and in an encounter with Hands, the last of the mutineers on the ship, killed him, and hauled down the black flag of piracy and brought the ship to the beach on the other side of the island. Elated at his success, Jim came ashore and started towards the stockade to boast of his achievements. There he was surprised to find the pirates in possession of the fort.

"So," shouted Silver as he caught the lad, "here's Jim. Looking for your friends? They've tramped, and you'll have to join with Cap'n Silver."

"Well," said Jim, "here you are in a bad way, ship lost, treasure lost, men lost. If you want to know who did it—it was I! I was hid in the barrel and heard your plans of mutiny. As for the schooner, it was I who cut her cable, and who killed the men aboard. The laugh's on my side. Kill me if you please, or spare me and I'll be a witness and save you from the gallows, when we get back to England."

One of the men started after him with his knife, but Silver saved him. "See here, Jim," said Silver, "tit for tat—I'll save your life and you save me from swinging." Thinking that Silver was deserting them, the other buccaneers held a council and handed Silver the black spot. But Silver pacified them, and showed them that he possessed the real chart.

Suddenly a voice sounded from the margin of the wood. "Blockhouse, ahoy!" it cried. It was the doctor, who had come to seek news of Jim.

The doctor stopped in surprise as he entered and saw Jim. Silver announced that Jim must stay with the pirates. "Jim will tell you how I saved his life," said Silver, "and were deposed for it, too."

The doctor went away again, and next morning Jim, under order from the buccaneers, followed them on their search for the treasure. After searching in vain for a long time, suddenly they came upon a ghastly human skeleton.

"Shiver my timbers! that's a p'inter," said Silver. "Flint killed his six men, and laid this one down by compass. That's his joke. Take a bearing along the line of them bones."

"Fifteen men on the Dead Man's Chest," a high, trembling voice sounded in the air, and the buccaneers in alarm stood rooted to the ground.

"Sounds like Flint, or, by the powers, Ben Gunn!" roared Silver.

But their courage gradually returned as Silver urged them on, saying, "There's seven hundred thousand pound not a quarter of a mile from here, so come on, and don't be scared of a spirit." The thought of the money swallowed up their previous terrors, and they continued the hunt. Suddenly Silver halted in front of a deep excavation, and saw on a board in front of the pit the name of Flint's ship—the Walrus.

Instantly the pirates realized that the treasure had been taken, but they dug frantically in the pit, hoping to find some stray coins. Suddenly musket-shots flashed out of the thicket, and those of the mutineers who were not killed threw down their arms and fled. The doctor and Ben Gunn emerged. The doctor recounted the story that Gunn had found the treasure and hidden it. The doctor had given Silver the useless chart and the provisions, and had lived with Gunn, sharing his storehouse of food. Gunn led the men to his cave and there on the floor lay great heaps of gold.

For three days they worked to get the coins aboard the ship, and then they sailed for home, reaching Bristol with only five of the original party. "Drink and the devil had done for the rest."

THE NEXT STORY OF FAMOUS BOOKS IS ON PAGE 3713.

THE TREASURE IS FOUND AT LAST

Captain Flint had buried the treasure and then had killed one of his men whom he doubted. Ben Gunn, who had been marooned upon the island later, found and removed the treasure. When Long John Silver, the leader of the mutineers, got possession of the map, the gang made for the spot where the treasure had been buried. While discussing what had become of the treasure, they were attacked by the other party.

Later Ben Gunn led Jim and the others to the cave to which he had removed the treasure. There were bags and chests which had rotted and the gold had spilled upon the floor so that one could pick up handfuls of it. It was divided fairly, and the Hispaniola had a safe voyage to the home port.
Pictures by courtesy of the White Studio.

A TOY RAILWAY FOR A GARDEN

These two pictures show a simple garden switchback, which if properly constructed and properly used, is quite safe, and affords plenty of exciting and healthy amusement. But it must be carefully and strongly made, and it would be risky to make it yourself unless you are an expert carpenter. A carpenter, or an engineer, is the right person to do the work, and any carpenter, after being shown these pictures, would know how to do it. The supports must be strong, the planks and rails securely fastened together, and both sides should be on the same level. If the wheels of the carriage have rubber tires, the working will be almost noiseless and much more pleasant than otherwise The switchback will work quite well with metal wheels.

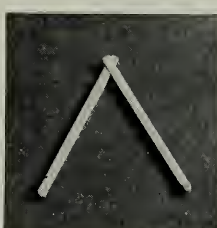
In the first picture the little girl is starting the boy; here the little girl is riding down the switchback. If the lawn or garden is on a slope, the starting-point should be at the top of the slope, and the finishing-point at the bottom. But the effect of a slope can be got on level ground by having the trestles or supports of different heights, with the highest at the starting-end. Even if the switchback is level, it can be made to work by the passenger inclining the body as if on a swing. The weight thus thrown forward sends the carriage along.

FUN IN A BOX OF MATCHES

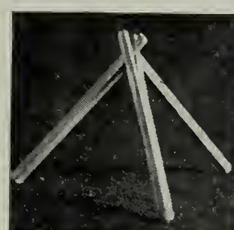
CONTINUED FROM 3558

A BOX of Swedish safety matches costs one or two cents. A good deal of amusement can be had with this little box, still leaving the matches perfect for their original purpose. The pictures that we see in this article can teach us some feats with matches.

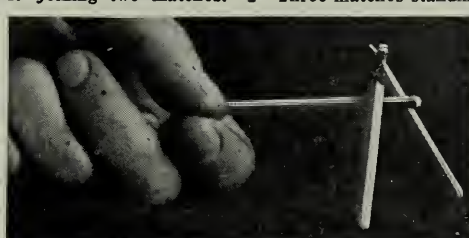
The first feat that we may try to perform is to lift three matches with one match. It sounds hard, but the pictures show that it is really simple. We first slit the end of one match a little way and trim the end of the second to a wedge-shaped point. We insert the wedge-shaped point into the slit, when the two will be the shape of an inverted V, as seen in picture 1. Now we place a third match as seen in picture 2, so that the whole three remain standing like the corners of a hollow pyramid. By inserting a fourth match as seen in picture 3, and then by gently moving the first two matches so that the third match falls on to the lifting match in the manner shown, the whole can be lifted with a steady hand.



1. Joining two matches.

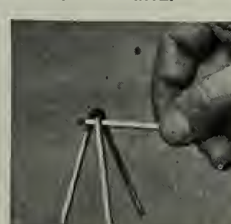


2 Three matches standing.



3. Lifting three matches with one match.

4. Tower of three matches.



5. Lifting the matches.

A similar trick can be performed rather more easily if the ordinary red-headed lucifer matches are used. In this case three matches are propped up with their heads upward, as seen in picture 4. Then a fourth match is lighted and the flame is made to touch the heads of the other matches, when they will take fire. The flame should be put out by blowing straight down upon the matches. Then, by using the fourth match in the manner shown in picture 5, all may be lifted. The burning of the three match-heads in close proximity has caused the heads to run together a little during combustion, and the ash of the three has sufficient cohesion to enable the feat to be carefully performed.

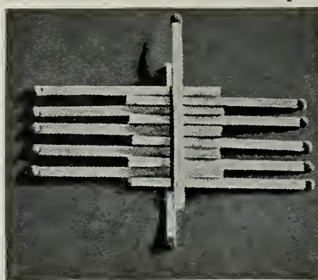
Now we may set ourselves the task of lifting several matches with one match. The number lifted may vary, but picture 7 shows eleven matches lifted by means of one match. This trick is performed more easily with square-shaped matches than it is with round matches, although with round matches it may be done also. The two rows of matches, as seen in picture 6, should be placed with heads outward and close together on top of the bottom match. The top match should be placed so as to leave room for the finger and thumb to grasp the bottom match without disturbing the arrangement. Then, by lifting as in picture 7, the feat may be accomplished.

Picture 8 shows twenty-four matches arranged so as to form nine squares, and the

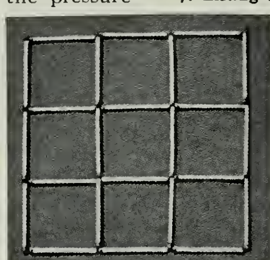
problem is to take away eight matches and leave two squares. The way to do this is shown in picture 9.

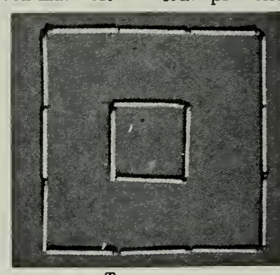
The next thing that we shall do is neither a puzzle nor a feat, but it is interesting. We take a matchbox and three matches, which we arrange like picture 10, with a match stuck head outwards into each side of the box and another match held between the two heads. The "spring" given to the two matches by pulling them apart so as to admit the third, will hold the third one securely. Then we tell our friends that we propose to apply a light to the middle of the third match, and invite them to say which of the other two will first take fire from the flame. In every case the opinion will be the match next to the head of the cross match. But this is found not to be so. The third match as it burns in the middle gets weaker, and soon the pressure of the other two matches upon its ends bends it and then makes it jump into the air quite a little way.

Now, there is a genuine trick that is a little mystifying if adeptly performed. We take a match in each hand, the hands resting palms upwards on the table. Then we close the hands and ask someone to place a match upon the closed fists, as seen in picture 11. We now say that we are able to pass the match from one hand into the other without opening the hands. We make a rapid up-and-down movement of both hands. This causes the two visible matches to fall on the table, and we ask our friend to replace them on top of the knuckles. He does so, and we make another rapid movement so as to cause the two exposed matches to fall into the hands. Then we open the hands, one of which is found to contain three matches and the other to contain only one, as seen in picture 12. The secret of the trick is that when we let the two matches fall upon the table they were not the two from the top of the knuckles of each hand, but one from the knuckles and one from the palm of the same hand. The movement we made caused one knuckle match to fall into the palm of the hand, so that, unseen by the spectators, when the two matches were seemingly replaced, one palm held two matches and the other was quite empty.


6. Arrangement before lifting.


7. Lifting eleven matches.


8. Two squares.


9. Two squares.


10. Which match will burn first?

The next trick to which we shall give attention is called the tramps and ducks. We take seven matches, two of which we retain—one being left in each hand—and the other five we place on the table in front of us, as seen in picture 13. Then we tell the little tale of the tramps and the ducks. "There were two tramps—the matches in the hands—who saw five ducks—the matches on the table—and resolved to steal them. So they took one alternately." Here we pick up the first of the five matches with one hand, the second with the other hand, and so on, alternately, until there are none left on the table. We resume the tale. "But before they had run away they saw the farmer coming, and so they put down the ducks again." Here we replace the matches on the table, one from each hand, alternately, until all five have been put down. "The tramps hid in a hedge until the farmer had gone, and then they took them up as before." Suiting the action to the words, we again pick up the matches one after another with alternate hands. Then, keeping the hands closed, we go on again. "But the tramps began to quarrel, and one


11. Conjuring with matches.


12. How is it done?

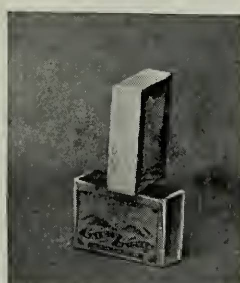
said to the other: You have got four ducks and I have only one.' And so he hid." Here we open the hands, one of which has two matches in it and one has five, as seen in picture 14. The audience is naturally very much perplexed at the result.

The secret of the trick is this. After we had picked up the five matches the first time, there were three matches in one hand and four in the other, as seen in picture 15. When we replaced the matches on the table we began with the hand having three matches, so that when the five matches were on the table again one hand had two matches and the other none. Of course, we did not let this fact be noticed. Then, when we picked up the matches finally, we began with the hand that already held two matches, with the result that, as we have seen, we finished with two matches in one hand and five in the other, as shown in picture 14. Picture 16 shows the last trick, which is performed not with matches, but with the matchbox. We place the two pieces of the matchbox in the position shown, intimate that it is our intention to bring our closed fist down with all our force upon the topmost point, and invite opinions as to which piece will be broken by the blow. We shall have some of our friends say that the upper part, being not so strong as the other, will break, while others will assert that the lower part, being underneath, will receive the full force of the stroke, and therefore break. But when we strike, no matter how hard, we shall find that the two pieces bound away unbroken. The result is so unlooked for and so unexpected that it generally causes much astonishment among the audience. This is only a little of the fun to be obtained from a box of matches. Other problems to be performed with matches are given on page 111, and the answers to them appear on page 1855.

13. The tramps and ducks.

14. The end of the trick.

15. The middle of the trick.



16. A trial of strength.

THE BOY'S HOME MUSEUM

MOST boys collect things—stamps, birds' eggs, fossils, coins, butterflies and moths, insects, shells, or botanical specimens. The pride of possession is a good thing in its place, but no boy should collect things merely to be able to say that he has them. He should learn as much about the things he collects as he can. If his hobby be the collection of birds' eggs, he should learn not only the names of the birds whose eggs he has, but he should also be able to identify the birds, to know something about their habits, and to recognize their nests. So with insects, shells, or any other things collected. The objects and their associations should be studied.

But orderliness should always be a characteristic of the boy who pursues the hobby of making collections. Therefore, every boy collector should possess a little museum to hold his collection. A museum is easily made, and every boy who is worth his salt can make one for himself

A very neat and convenient little museum can be made from a wooden box, which we can probably secure from the groceryman. Line the inside walls with green cartridge wall paper. Then get five or six pieces of board the size of the inside of the box, and nail in a couple of shelves. These shelves are to hold the trays for our collections. The trays can be either the ordinary lacquer trays you can buy in shops, or little wooden trays made out of strips of strong thin wood nailed strongly together. The trays are most necessary, as we will want to draw our collections out without disturbing any of them. In cases where the collection is of some frail or perishable things, such as butterflies and moths, it would be well to cover the tray with a strip of glass cut to fit over it tightly.

Now, this museum is not at all difficult, and every boy could, if he liked, easily make one something like it. Why should he not try? In his museum he can have one tray for fossils or rocks, another for odd coins, and so on.

SOME GAMES FOR OUT OF DOORS

GARDEN QUOITS

GARDEN quoits should be played with wooden rings, or wire ones bound with some soft material. A peg is driven into the ground, and the players stand at a distance, each having a number of rings. They then throw in turn, and those who get the greatest number of rings over the peg win the game, and any prizes that may have been offered.

CUDGEL

TWO small holes, ten feet apart, are scooped in the ground, and round each a circle about a foot wide is drawn. At these holes two batsmen stand, each armed with a short stick, one end of which is held in the hole. From a short distance away, two bowlers pitch, in turn, a small piece of wood, called a cat, towards the holes. If it drops into one of the holes both batsmen are out, but if it is struck by one of them they change places as quickly as possible while the bowlers try to drop the cat in a hole before either of the batsmen can protect it by popping in his stick. If the cat is pitched by a bowler so as to fall inside the circle surrounding a hole, he picks it up and runs to a little distance with his partner.

They then decide between themselves, without the batsmen knowing, which shall hold the cat, and then return to ask the batsmen to guess who holds the cat. As the question is asked they both kneel down, one opposite each hole, and the batsmen answer by simply standing together opposite the bowler they choose. If the guess is correct the game must go on as before; if wrong, the boy holding the cat at once pops it into the hole by which he is kneeling, and the batsmen become bowlers.

HOP, SKIP, AND A JUMP

SCRATCH a line on the ground, and stand so that the toes just touch it. Then, lifting one foot, hop as far as possible. Follow this with a skip, and then, with both feet together, give a long jump, remaining quite still at the end of it till someone has drawn a line where the heels struck the ground. Each player in turn does his best, and the one who covers the greatest distance with his hop, skip, and a jump is the winner.

OBSTACLE RACE

THIS is great fun and will show the different ways boys have of getting over difficulties. Instead of the racecourse being kept open, obstacles are put up at different places for the runners to get over as best they can. Those who do so most quickly are likely to reach the winning-post first. For small boys these obstacles should not be too troublesome. The first might be a long hurdle for them to climb; the next, a row of bottomless canvas sacks side by side on the grass, one for each boy to crawl through, and perhaps beyond these a number of ordinary school slates pegged to the ground with pencils attached, upon which each runner must write—quite distinctly—a short sentence arranged beforehand, adding his number instead of his name at the bottom of the slate. Other kinds of obstacles, however, will very soon suggest themselves to those who manage the race.

GUARD THE BLOCK

IN the middle of a large circle an old tin or small block of wood is placed, and the "keeper" stands over it to guard it. The rest of the players try to kick it out of the circle, and when one succeeds they all run away and hide. The keeper then replaces the block, and sets off in search; but he dare not go far in case one of the enemy should run from hiding and steal his block again. The moment he spies anyone, he calls out his name and races back to the block to touch it before the boy he has found can get there. If he succeeds in doing this the other becomes his helper, and the first keeper may more safely go on with his search; but he should not go too far, lest several of the hiders come out and attack his new partner. In that case he would have to begin all over again. Every time anyone is found the keeper must touch the block, and when more than half the players have in this way become assistant keepers, the rest must return from hiding, and a new keeper is then chosen.

THE LEAPING-POLE

THE leaping-pole should be of strong wood, quite smooth, and not too heavy. The boy who uses it should not hold it too high up to begin with, and should not try to jump too far. He ought to make a short run and, taking a firm grip with both hands, putting the right a little above the head and the left about two feet lower down, plant the foot of the pole on the ground, and lift himself up as it swings over. The height and length of the jumps should be increased by degrees. There is no healthier exercise than that with the leaping-pole, if it is used as it should be.

THE JOLLY MILLER

THE miller stands in the centre of a circle formed by the rest of the players walking round and round in couples, arm in arm. They sing this song as they walk:

"There was a jolly miller and he lived by himself,
As the wheel went round he made his pelf.
One hand on the hopper, and one on the bag,
As the wheel went round he made his *grab*."

At the last word the couples change partners. Each outside player moves forward and takes the place of the inside player in front, who, at the same time, occupies the place left vacant by his partner. If the miller, however, can get a place first, the player who is left without a partner must take the place in the centre of the walking ring or wheel, and wait for the chance of "grabbing" someone else's place when the verse has been sung again.

PREPARING A PICNIC LUNCH-BASKET

WHEN we go for a picnic, it is best to take things which weigh as little as possible, if we have to carry everything ourselves, for we do not want a heavy load to tire us before we reach the spot decided on for lunch. So we choose a lightly-made wicker basket and light cardboard boxes for the eatables. We replace china plates by plates made of paper, linen serviettes and tablecloth, by paper napkins and a paper tablecloth or doilies which are made especially for picnic parties, a salt-cellar by a screw of paper, and so on, taking as few knives and forks as we can possibly do with.

One or two teaspoons passed round to stir tea or coffee before drinking it will be found enough. Half the fun of a picnic is the contriving it involves in the absence of table accessories. Little paper cups will do quite well in place of ordinary cups and glasses. As for the eatables, it is well to take things that will not spoil, crush, or melt when packed up, so we must avoid juicy, over-ripe fruit, and if it be the strawberry or raspberry season, take only the dry ones. They carry best between cabbage leaves, on the top of the basket, or in a box covered with leaves. Bananas, plums, greengages, peaches, apricots, apples, and oranges are quite easy to carry. Our lunch may be a very simple one, just enough to satisfy the hearty appetites of boys and girls, or something more elaborate to entertain our friends. Suppose we think about a simple lunch first.


A family picnic in the woods.

We shall find hard-boiled eggs and bread and butter very satisfying, and easy to carry. The eggs are boiled for five minutes, and then placed in cold water for two or three minutes to harden them still more. We wrap each one in white tissue-paper and place them all in a card egg-box at the bottom of the basket, with a paper screw of salt. To eat with the eggs, we want slices of bread and butter. The slices should be cut the same size, and placed butter sides together in a pile. We may like to put between two slices a little mustard and cress, small sprigs of watercress, shredded lettuce leaves, or chopped nuts. The bread and butter or the vegetable sandwiches are then covered with oiled paper, such as confectioners use. The eggs can be cracked, shelled, and halved at the time of eating.

For those of us who do not care for eggs, we cut sandwiches of sliced tongue, ham, cold roast beef, or sausages, using a sandwich loaf of bread for the purpose, and taking care to cut the meat thin, and sprinkle over it a little salt, and mustard. Potted meat may be preferred, and is very quickly spread. Pressing the pile of sandwiches down with the left hand, we take a large, sharp carving-knife and cut off the crusts from the four sides of the pile. The sandwiches are then done up in packets of oiled paper, covered with thick white paper.

Another favorite item of a simple picnic lunch is chocolate sandwiches. Indeed, a fancy roll and a thin cake of milk chocolate followed by one or two bananas and a few raisins, make a meal that will be found most satisfying.

If we have New England boys or girls in our picnic party they are sure to like a pie, and home-made sausage rolls generally meet with approval. They are easy to pack in paper or a card box.

A few little fancy cakes or biscuits, and fruit in sound condition, will be put on the top of our basket, and we shall hardly need knives and forks, a clasp fruit-knife being alone wanted for the fruit. In choosing the spot for lunch, we may have in mind a cottage or farm near, where we can get a supply of drinking-water or milk. Failing that, we shall certainly need a bottle of milk and some mineral waters. Sherbet often meets with approval. It is not a bad plan for the different parties who join the picnic each to contribute provisions for the lunch, thus sharing the expense and dividing the burdens. One may be famed for a special kind of sandwich, another for pie or fancy cakes, another for lemonade. It is well in such a case to have a clear understanding about the contributions, so that provisions do not run short.

Now let us suppose a somewhat more elaborate lunch is to be packed, involving cold chicken, lobster, or veal loaf, and requiring knives and forks. Of course, we do not take our best knives, and so we cut up the fowl before packing it in oiled paper and wrapping it in a serviette outside that. Shredded lettuce goes well with the chicken, packed between two large outer leaves or cabbage leaves. There is no need to carry home greasy knives and forks. Kind earth cleans them nicely for us, if we just dig them sideways in the turf and wipe them on some of the tissue-paper.

If we are near a wood where sticks can be gathered, it is fun to light a fire and bake a few potatoes, with their coats on, in the ashes, or boil a kettle over large stones placed around it. Then, if we care to take a small spirit-lamp and apparatus, we can indulge in tea or coffee. Evaporated milk, which should remain unopened until we are on the spot, makes a very good substitute for cream; and a small pot of jam or marmalade is sure to meet with much appreciation from all.

OUR LITTLE VEGETABLE GARDEN

WHAT TO DO AT THE END OF JUNE

We may still continue the routine work, pinching out side growths from the tomatoes, and planting out the young "greens," thinning the carrots and beet, the lettuces and radishes, and getting the late celery into the trenches. Very soon we should begin to enjoy our earliest crops of lettuces, radishes, peas, and so on. The drier the weather, the more frequently should the hoe be used to keep the surface stirred and loose, and also, of course, to keep down weeds; and frequent watering may be necessary for the freshly transplanted young vegetables.

It is always a good thing, if we can manage it, to keep a small portion of our little plots as a nursery garden, where we may put in cuttings that we want to strike. Small seedlings may be planted here until we have space to remove them to their flowering quarters; and here, when the time comes, we may put in the runners of strawberries to root.

Some people who have not sufficient room to grow strawberries in their gardens make use of a novel method very successfully: they grow them in barrels, and in this way grow quite a number of plants on the smallest amount of ground space possible. The description as to how strawberries may be cultivated in this way may induce some of us to try the method. This is how it is done. A large barrel is obtained, and holes are made all round it about three inches in diameter, with a foot or fifteen inches from hole to hole. This means, of course, that there will be several tiers of holes, and each hole is to contain a strawberry plant. If kerosene barrels are used, all traces of the oil must first be removed; then they are filled with soil, which must be made quite firm and be given ample time to settle; more soil may be added later. Some people, in filling the barrels with soil, place a pole in the middle of the barrel and build up the soil round it; when quite filled they remove this and thereby have a space which will hold water.

After the watering, it is as well to replace the pole—that is, of course, when the water is absorbed. The barrel should be filled some time before planting, so that the soil may become thoroughly firm, but in the meantime it should be watered, for if the bulk of the soil becomes dust-dry, it is very difficult to get it thoroughly moist again. We are thinking about this now, because early in July we may root our strawberry runners in readiness for the autumn, when we may establish them in the tub; but there is, of course, no hurry to fill the tub with soil for some while yet — it is the plants which must at present occupy our attention. But even now we may draw up a little soil around these runners while still on the plants. As a general rule, it is not a good thing to let the runners form; they should be cut off as they appear, in the same way as violet runners; but if we want to form plants, as many runners as we require plants must be allowed to remain. If the soil is drawn up round them, probably when the runners are removed they will be found to have already formed roots.

It may sometimes be necessary, even at the height of summer, to do a little planting in our flower garden; something may have failed or died, and we have an empty space to fill. Now, such planting requires considerable care, especially in hot, dry weather. If the plants we are to deal with are already growing in pots, there is not so much difficulty. We should water in the morning, and not attempt to plant them out until the evening. Having planted them, we should again water them, both at the root and, with the rose on the can, overhead. Shade for a few days is very desirable, and we may put some sticks into the ground around the plant, and then arrange a bit of light sacking, or anything we can find, round the outside of the sticks, and another piece lightly over the top. These can be removed during the night and replaced for the day for a short while, say, three or four days, unless it is cloudy and showery, when this shading will scarcely be necessary. But it is well worth while taking trouble to prevent a plant from receiving a severe check, and with this due care as to shading and watering during the first few days after moving, we need not hesitate to transplant a subject even in full flower if it be necessary.

We must look after our young seedling plants of wallflower and sweet-williams, and other things that we have been growing for next year's flowering. They should be pricked out in our nursery bed as soon as they can be conveniently handled, and they must be kept clear of weeds and watered when necessary. We shall plant them out where they are to flower in the autumn.

ANSWERS TO THE PICTURE-PUZZLE ON PAGE 3559

On page 3559 we have a drawing of a large steamer beside a quay, and in it the artist made several mistakes. Here is a list of them.

1. There is no name on the bow.
2. The portholes open outward instead of inward, as they should open.
3. The scupper is opened the wrong way.
4. The rattlings are unfinished.
5. The numbers should read upward.
6. The foremast is leaning forward instead of backward.
7. The funnels also should lean back.
8. The waste steam pipes should be in front of the funnels.
9. The anchor-chain hole is the wrong way.
10. No ship in dock has an anchor down.
11. There are no ventilators, halliards, foretop-mast stay, or side-light board.

THE NEXT THINGS TO MAKE AND THINGS TO DO BEGIN ON PAGE 3783.

WHAT THESE PICTURES SHOW US

THE REAL WEALTH OF A NATION

NOTE.—By the Laws of our country we are not permitted to show pictures of the money we use in the United States, but the laws of Great Britain are more liberal. The British mint is in London, with branches in Canada and Australia. The chief mint of the United States is in Philadelphia, with branches at San Francisco, Denver, and New Orleans.

CONTINUED FROM 3586

LONG ago there was no money anywhere. But as soon as men began to build homes, to till the earth, and to breed cattle, there arose a need for something which should represent these things. A man might want to exchange a sheep for a goat, and that was simple enough; he could give his sheep to his friend and take the goat home in its place. But if he wanted to buy the goat without giving the sheep in exchange it was not so easy. Or if he wanted to sell his house and build another it was not easy. It is not easy to be always handling goats and houses. So men agreed that instead of handling goats and houses they would handle something else which *represented* goats and houses.

The thing they agreed upon was money, and money *may be made of anything.* In some parts of the world people use shells as money, and in nearly all parts of the world they use paper, printed in a particular way so that no one can copy it.

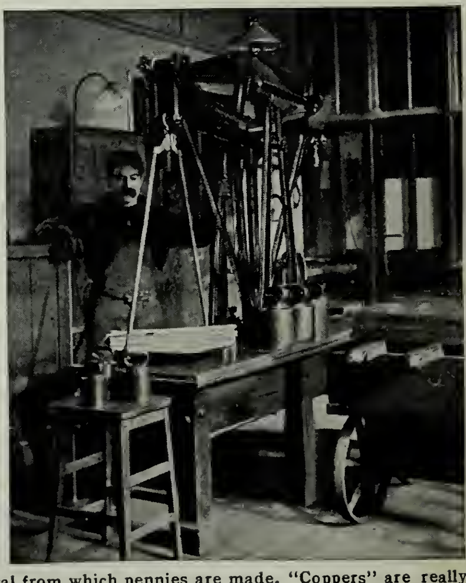
But most commonly the things used are coins made of certain metals, with their value marked on them. The coins are, of course, of no use in themselves. You cannot eat gold, or drink it, or make clothes out of it. A great Englishman, John Ruskin, said, many years ago, that if all the money in the world were destroyed, human beings, taken altogether, would not be any richer or any poorer than they are now, as they would be if all the bread in the world were destroyed, or all the clothes. If all the money were destroyed, all that would be lost would be simply the amount of power which some people possess over others. It is true that some of the things of which money is made, such as gold and silver, can be made into beautiful ornaments, so that the metals have some value in themselves; but that is a pure accident. We use gold and silver for money simply because no one can make gold or silver, and we practically know where all the gold and silver in the earth are. If, to-morrow, a great mountain of gold were found, we might have to fix on something else of which to make money

John Ruskin said that "there is no wealth but life,'' and he told us that the real wealth of a country is not the amount of the coins, or counters, or bank-notes, that it possesses, but *its people,* and, not least of all, *its children.* Everything else that can be named is nothing at all compared with this. The real wealth of America is not in the banks of America, but in the homes.

Unfortunately, most people do not understand these things. Some day, perhaps when the boys and girls of to-day grow up and rule America, we shall spend more time *and money* taking care of *the real wealth* of America, its men and women and boys and girls.

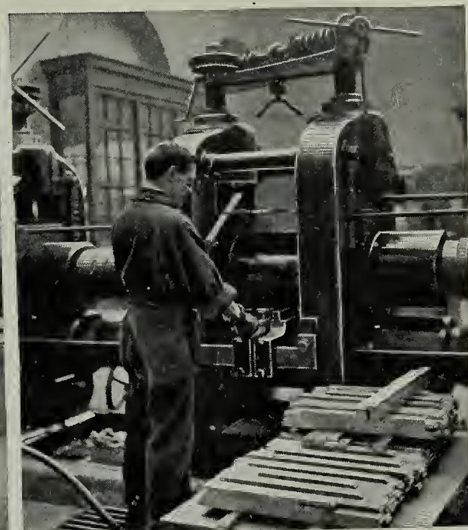
WHERE THE MONEY IS MADE

This is the Mint in London. The great money factory stands on the banks of the Thames, almost in the shadow of the gloomy Tower of London. From this building comes nearly every sovereign spent in England, every gold and silver coin in the land, indeed, except those that happen to come from Canada or Australia. The Mint could make a million sovereigns in a week, but the money actually made is much less. These pictures show how a penny is made, and they would be similar in the case of a sovereign.



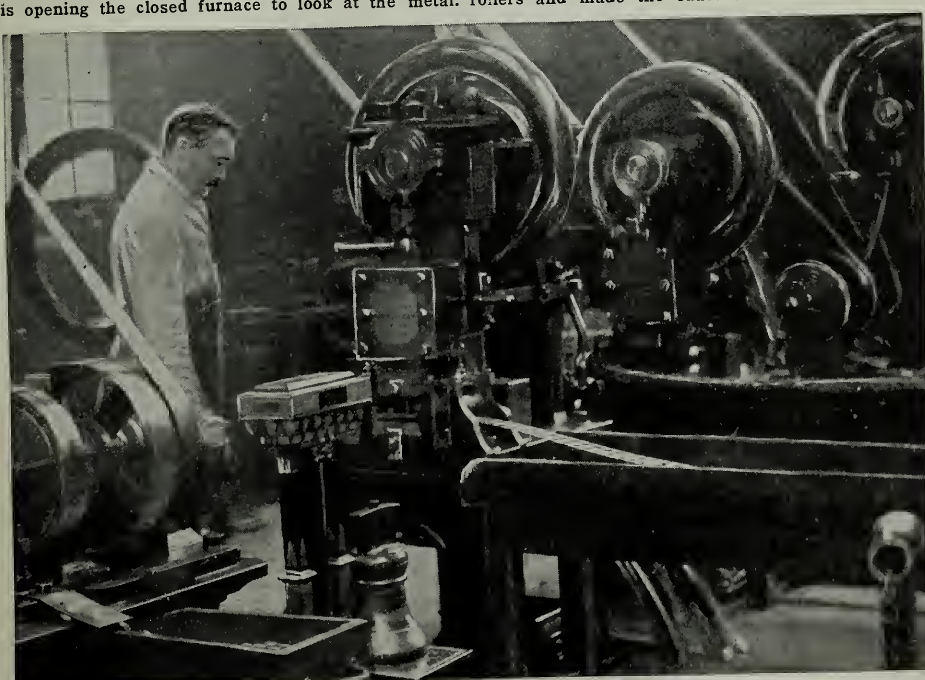
The first of these pictures shows us a stack of the metal from which pennies are made. "Coppers" are really made of bronze, which is a mixture of copper, tin, and zinc. In the first picture tons of bronze are stacked up in long bars; the second picture shows us the weighing of the metal before it goes to the rolling-room.

MAKING THE METAL INTO LITTLE ROUND PIECES



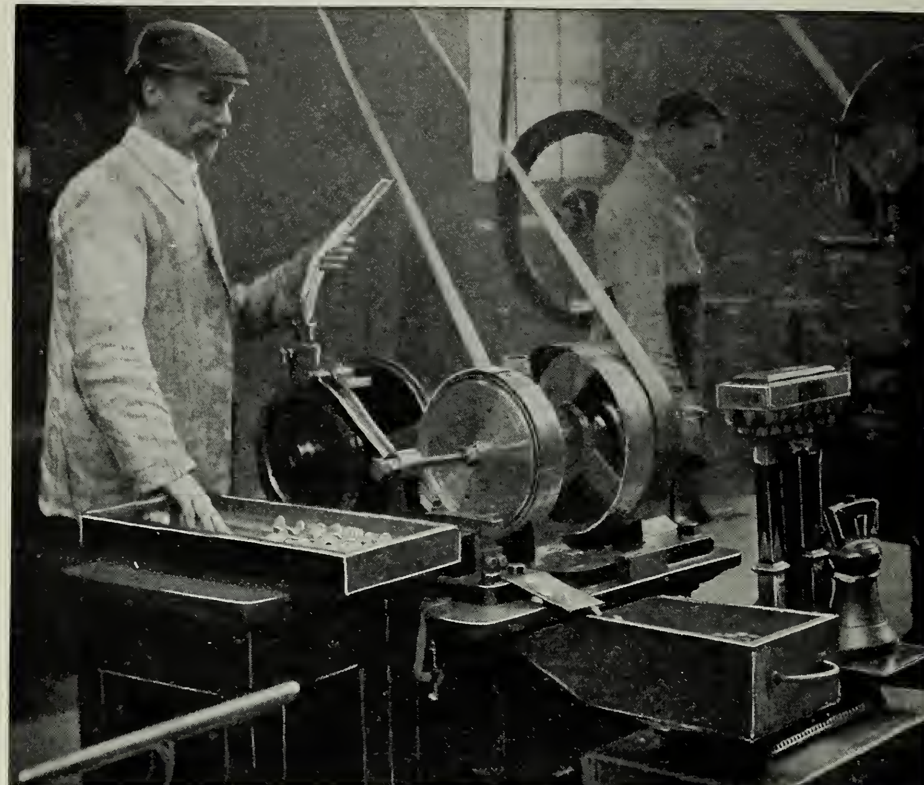
The metal is here being melted in the furnace. It is put into a closed "crucible," or melting-pot such as we see stacked up in this picture, and the crucible is then placed in a closed furnace, where the heat melts the metal until it runs like water. The man here is opening the closed furnace to look at the metal.

The melting purifies the metal and frees it from anything that may have been mixed with it; and the pure metal is poured into long, thin molds, or iron boxes, and allowed to cool. It comes out of these molds in long, narrow strips, which are pressed through rollers and made the exact thickness of a penny.

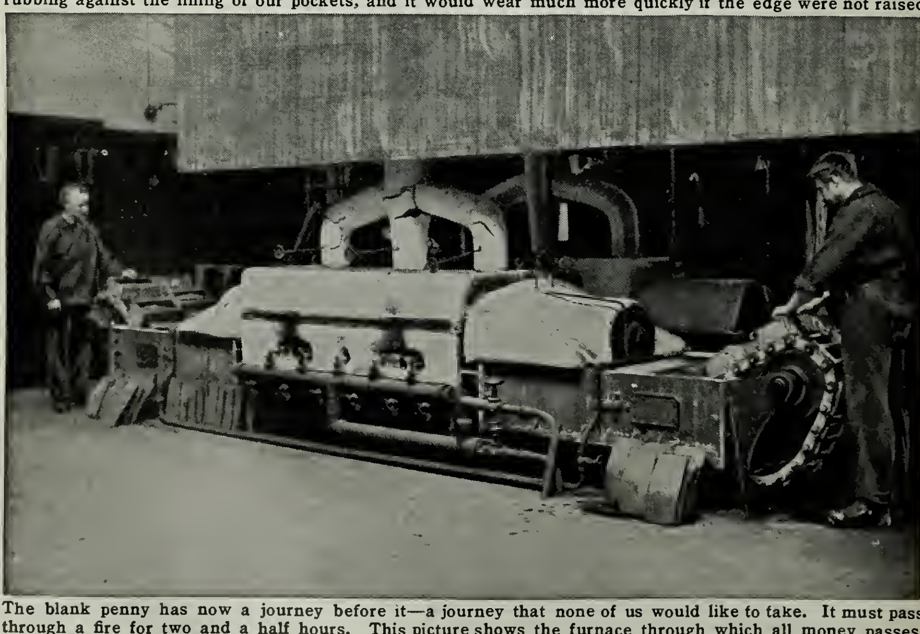


The long, thin strips of metal then come to this machine, which cuts them up into little round disks the exact size of a penny. This machine, called the "cutter," works so rapidly that it cuts out about five hundred pennies in a minute. The metal strips, as they are cut off, fall in a heap on a tray underneath, and are taken back to the furnace to be melted down and used in the same way, so that nothing shall be wasted. The pennies are now the proper shape and size, but they must be passed through another very wonderful machine and be well baked in an oven before they are finished and ready for use.

A PENNY'S SLOW RIDE THROUGH A FIERY FURNACE



If you will look at a penny you will notice that the edge of it is raised all round. This is the machine that raises the edge, in order to protect the face of the coin. Money wears away with constant handling and by rubbing against the lining of our pockets, and it would wear much more quickly if the edge were not raised.



The blank penny has now a journey before it—a journey that none of us would like to take. It must pass through a fire for two and a half hours. This picture shows the furnace through which all money passes, carried round in iron boxes on an endless chain. When the penny has been "baked" it is ready for stamping.

THE MAN WHO TOUCHES ALL THE PENNIES

This is the machine that stamps the pennies. They are dropped through into the sloping tube seen at the left of the picture, at the bottom of which they are struck between two dies, coming out stamped on both sides as here shown. On one side is the picture of the King; on the other is the name of the coin, the year in which it was made, and the figure of Britannia which is meant to represent Britain as mistress of the seas.

Every coin made at the Mint must be properly tested. The men in this picture are examining them. They touch all the pennies before they leave the Mint. The coins pass before them on a moving belt, on which they are placed by the man at the left. As they pass slowly by, the man with the wonderful fingers examines them to see if they are properly made. If badly made or a bad color he at once notices it and they are thrown out. If good they are carried on by the belt and are dropped into the tray seen near the man to the right.

THE MACHINE THAT COUNTS THE PENNIES

This is the most wonderful machine at the Mint. After the coins have been weighed they are placed in bags and brought to the counting machine. This machine counts them all without mistakes. The truck full of bags is pushed under the platform, as seen in the picture, and the bags are carried to the top in a small lift. The man at the top empties the bag on to a plate, and this wonderful machine does the rest. It tests the coins once more, counts them, weighs them, and finally drops them into bags ready to be issued.

The bags of pennies are packed in boxes, as seen in picture, and taken to the room from which they are sent out. All the sovereigns go straight from the Mint to the Bank of England, but the silver and bronze coins are circulated in many ways. The boxes seen in this picture are packed for Australia, and some of the pennies have probably by this time been put in savings banks by children at the other side of the world.

THE NEXT FAMILIAR THINGS BEGIN ON PAGE 3757.

This photograph of the sun shining at midnight was taken in Norway when it was as light as day.

NORWAY, SWEDEN & DENMARK

CONTINUED FROM 3550

ONCE upon a time, the very far-off time when the British Isles formed part of the continent of Europe, the great Alpine heights were linked with the Northern Sea by a river much longer and fuller than the Rhine is now, for its mouth was between Scotland and South Norway.

As ages went on, the land rose, though not very much, as we read in the story of Holland and Belgium, but enough to give shape to the shallow North Sea, more or less as we find it now, washing the shores of Great Britain, Holland, and Denmark.

Denmark is one of the very few peninsulas in the world that point northwards. Its surface is flat; in some parts it has to be protected from the sea by dykes, as in the case of Holland. The islands that lie to the east of it form stepping-stones to the great peninsula of North Europe, which is more than five times the size of Michigan. This is called the Scandinavian Peninsula, and stretches southwards from its northern neck of union with the continent for over a thousand miles, till it almost touches the islands of Denmark. A great backbone of mountains runs down the length of the peninsula. Many of the heights of these Scandinavian Alps are between six and eight thousand feet. There is a long, gentle slope, with numerous rivers and lakes draining eastward to the Baltic and a steep, short slope westward to the Atlantic. The Baltic has been called the Mediterranean of the North, so useful has it always been as a highway of communication for the people dwelling on its shores. The mountains divide the peninsula into two distinct countries—Sweden to the east, and to the west Norway, slung like a bag on the shoulders of Sweden.

In the Museums at Copenhagen and in the Prehistoric Room at the Bristish Museum is to be seen part of a kitchen dust-heap from Denmark, thousands of years old. In it can be distinguished oyster-shells, bones of birds, worn-out stone knives, and good ones too, for people even then were sometimes careless. These rubbish-heaps, with their tale of hard living on wind-swept shores, were formed by some of the earliest dwellers in North Europe. Others have left traces of their presence in the weapons and tools of stone found in different parts, and in their burial mounds; while to rather later times belong the treasures of metal objects and carved stones now so carefully collected and studied.

From the heart of Asia, a few centuries before the birth of Christ, there came the great Teutonic, or German, family of peoples. Some settled, as

we see on page 2549, in the body of Europe; others pressed on to the peninsulas and islands of the North, gradually driving the older peoples whom they found there—the Finns and the Lapps—farther and farther to the frozen North, where their descendants are found to this day in Finmark and Lapland, between the head of the Baltic, that is called the Gulf of Bothnia, and the Arctic Ocean.

HOW THE NATIONS OF SCANDINAVIA GOT THEIR PRESENT NAMES

The newcomers, who became known as Scandinavians from the name of a province, Scanea, settled in what is now the extreme south tip of Sweden; and the names of Swedes, Danes, and many others come from the leading tribes that settled in various parts. The name Norsemen, or Northmen, comes from the position of the country in which these hardy folk found their home, in the north-way between ocean and mountain.

The Romans, as we have seen, did not push their conquests farther north than the mouths of the Rhine, and any Roman remains found in Scandinavia were carried there in the course of trading. And so all the long years when the Romans were setting in order Gaul, Spain, Germany, Britain, and leaving lasting traces in these countries, the Scandinavian peoples were working out their own development in their own way, in the fertile fields of Denmark, on the peninsula of Jutland and the neighboring islands; by the grand, clear lakes and rivers and the boundless forests of South and Middle Sweden; and round the wonderful inlets of the sea in Norway, called fjords or fiords, like the firths so common in Scotland.

THE NORTHMEN, WHO THOUGHT THUNDER WAS THE PASSING OF THEIR GOD

The religion of the Scandinavians was much like that of their next-of-kin, the Angles, Jutes, and Saxons who invaded Britain. Like them, when they saw the bright rainbow in the sky, they believed it was the bridge by which the gods rode to their home, Asgard; and when they heard the roar of the thunder, it was to them, Thor the Strongest rattling past on his cart or banging his great hammer. Like the Angles and Saxons, too, they believed that the great All-Father Odin, or Woden, received all slain in battle to feast for ever in his great hall, Valhalla. For war was their principal occupation, and the chiefs went on fighting each other for possession of desirable tracts of land that gradually grew into small kingdoms. At last, towards the close of the eighth century, some 300 years after their cousins had migrated across the sea to Britain, a sudden activity stirred in the hearts of the dwellers of the fiords, and some of their neighbors in Denmark or Sweden. It seemed as if they were tired of fighting each other, and longed for a wider field for adventure and glory. And so the Norsemen burst like a destructive tempest over lands, by this time somewhat civilized and Christianized, on the coasts of Ireland and Scotland, on the groups of islands near them, and on the coasts of England and France.

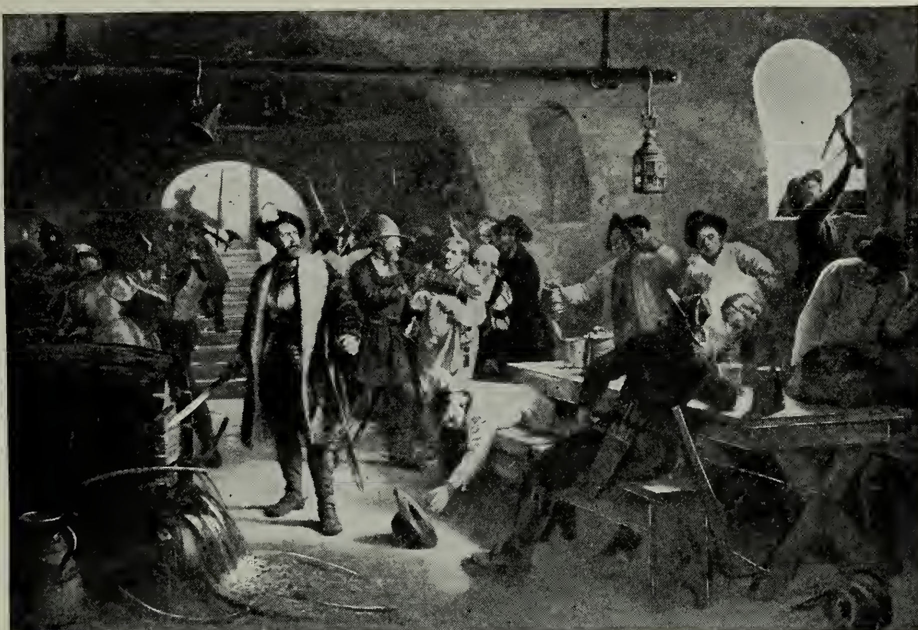
"From the rage of the Norsemen, deliver us, O Lord!" was the prayer that rose up from far and near, as churches and farms were burned, and people were killed or enslaved, while their worldly goods were carried off to the ships of the Vikings, the fierce men who lived by the creeks or fiords.

THE STIRRING STORIES AND INSPIRING SONGS OF THE VIKING HEROES

For a time they were content to depart with their booty, returning year by year for more; and then they began to settle in the attacked countries. We see in the story of France, beginning on page 2067, how Rollo founded Normandy, and how sadly Charlemagne watched the Norsemen in the Mediterranean. Other Norsemen settled in Iceland, and the islands to the north of Scotland, where their descendants are still known by their Scandinavian names and appearance, and in Ireland.

Beyond once sailing up the Thames, the Norsemen seem to have left England chiefly to the Danes, about whose struggles with Alfred we read on page 468. The stories of these times are related by poet-historians, whose writings, or sagas, have been handed down, and collected, and greatly studied. They give so many particulars of vivid scenes and stirring conversations between the heroes, of their garments and songs, of their bravery and feasting, that they make the wild old times live again, those times when the rusty old swords and spears we see in museums were new and

THE HERO-KINGS WHO MADE SWEDEN GREAT



Gustavus Vasa, the deliverer of Sweden, was crowned king in 1523, and under him Sweden became a Protestant nation. He was a good king, hated drunkenness and gluttony, and did much to elevate his people. In this picture, by the famous Swedish artist Saloman, we see him engaged in his crusade for pure living. He has come suddenly upon a drinking party of his subjects, and has with his sword destroyed a barrel of liquor.

Gustavus Adolphus, king of Sweden, knew eight languages, was a clever statesman, and a brilliant general. When he championed the Protestants of Germany, he made the emperor's forces fear the " Snow king and his bodyguard," as he and his small army were called. He was everywhere victorious, but at Lutzen, in 1632, although the Swedes won, their king was slain. Here we see him praying for victory before the battle.

These photographs are by J.Valentine, Underwood & Underwood, London, The Photochrome Company, and others.

bright, and the drinking-horns, which could not be set down till they were empty, were filled, again and again, at feasts where the warriors "tumultuously rejoiced"; and the combs were used to straighten the flowing locks of the Freemen. There is one of these combs at the British Museum with the inscription "Thorfast made a good comb."

THE TERRIBLE NORSEMEN, WHO BROUGHT NEW LIFE TO THE OLDER NATIONS

These Northmen, terrible as were their descents on the countries they attacked, infused a breath of new life into them which has lived on. They had a wonderful power of adapting themselves to the manners and speech of the people among whom they settled. In Normandy the Northmen became French; in England we know how the Danes mingled with the English.

In the meantime, in the big and little peninsulas, and on the islands between them, the three kingdoms were gradually settling down, and for about four centuries, from the tenth to the fourteenth, they kept fairly distinct and independent of each other, though for a time the kings of Denmark, Sweyn and his son, Canute the Mighty, were practically emperors of the North, ruling not only over Denmark, Norway, and part of Sweden, but, as we read on page 472, over England across the sea.

Sweyn's father had adopted Christianity for Denmark. In Norway, about the same time, there were two kings named Olaf, whose doughty deeds forced Christianity on their unwilling people. The second Olaf, with the flaming red beard, is St. Olaf, the great hero of Norway, for his adventurous life, and still more his tragic death, took firm and lasting hold of the imagination of his fierce countrymen.

OLAF, THE HERO-KING OF NORWAY, WHO FACED THE ANGRY PEASANTS

After helping Ethelred of England against the Danes, he bided his time till he could establish his claims to his father's throne. Facing his angry people, who objected to his reforms, he struck down their idol with his club, and after many battle-cries of "Forward, Christ's men, Crusaders, the king's men!" and "Forward, forward, peasant men!" Olaf fought his last desperate fight on August 31, 1030. The date is fixed, because as the king died there was a total eclipse of the sun, terrible to the peasants, who thought it a sign of God's anger. St. Olaf was buried at Nidaros, at the mouth of the Nid, on the Trondhjem Fiord.

It was in the days of the Olafs that Leif the Lucky sailed away to the West, and was the first European to discover Greenland and part of the shores of North America.

Another name stands out in these early days—that of Sverre, who led the Birchlegs, so called from the bark they bound round their legs, against the Baglers, who represented the Church and nobles, in wild contest for the kingdom. The bravery of Sverre and his Birchlegs was splendid; the old historians tell us how Sverre put down the nobles who oppressed the people, and how he maintained law and order, after long and fierce fighting by sea and land, between the old towns of Bergen and Nidaros. The Pope excommunicated him, but Sverre defended himself.

THE CAPTIVE CHIEF WHO TOLD A DYING KING THE WONDERS OF THE EAST

The Bagler chief with whom he last fought had been on a crusade to Constantinople and Jerusalem, and when the two, both ill, were lying side by side on the ship's deck that was taking them to Bergen, as they gazed at the clouds fleeting across the wintry sky, the conquered Bagler told his conqueror, Sverre, about his wonderful adventures in the East, and of the glories of Constantinople. Sverre died on landing. He was one of the greatest kings that ever ruled over Norway.

Two centuries after his death, all three kingdoms were united for about 125 years under the rule of Denmark. This time was marked by many struggles among the three kingdoms and also by wars with the Hanseatic League, which had become very powerful. The League had several stations in Scandinavia, besides the famous one in Bergen.

Norway suffered terribly from the plague called the Black Death, brought by an English merchant to Bergen. Whole populations were swept away, and centuries passed before the country fully recovered from the loss to trade, and agriculture, and progress. Sweden broke away from the Union of Calmar, as it was called, when its great king,

THE THREE CAPITALS OF SCANDINAVIA

Christiania, the capital of Norway, named after King Christian IV., who founded it in 1624, is situated amid beautiful scenery. It is growing in importance every year. This view of the city is taken from the palace.

Stockholm, the capital of Sweden, is built upon islands, and the name means "log island." For several months every year the harbor is closed by ice. This picture, which shows the Sluice Bridge, looks north.

Denmark's capital is one of the finest seaports on the Baltic Sea, and its name of Copenhagen means "the haven of the merchants." It has a very considerable trade, and is the only first-class fortress in Denmark.

Gustavus Vasa, rose to power. The union between Denmark and Norway went on for another 300 years. During this time Norway may be said to have no history. It was miserably oppressed and powerless. For in Denmark, for some time, the king was but the tool of the nobles, who ruled as they chose in both kingdoms. In the year of the Spanish Armada, 1588, King Christian IV. became King of Denmark and Norway, and during his long reign matters considerably improved.

Christian IV. was a very energetic king, and traveled over his kingdom right up to the Arctic Circle, punishing officials who were doing wrong. He was also a great builder. Christiania, now the capital of Norway, and Christiansand, a port on the south of Norway where many steamers touch, were founded by him, and he improved the harbors of Denmark.

THE WEALTHY NOBLES WHO REFUSED TO PAY THEIR TAXES

He had much trouble with the nobles of Denmark, who, though very wealthy, refused to pay their share of the taxes. After his son came to the throne, the Royal Council, composed very largely of incompetent nobles, was done away with, and in 1660 the king became absolute, ruling without a constitution. Two years before, Denmark had lost the land she held in the south of the Scandinavian Peninsula.

The duchy of Schleswig, chiefly Danish, which had for years been shifting from one ruler to another, came under the rule of the King of Denmark in the reign of Frederick IV. Later on, the King of Denmark also became Duke of Holstein. The duchy to the south of Schleswig, Holstein was chiefly inhabited by Germans.

This period, while Denmark and Norway were united, was the time of Sweden's greatest glory, followed, unhappily, by a time when the gains of its hero-kings were nearly all lost again. Gustavus Vasa adopted the Protestant teaching of Luther. Though some Catholics lost their lives, the changes in religion came about more quietly in the northern kingdoms than elsewhere. Gustavus Vasa's grandson, Gustavus Adolphus, was the "Snow king" of the Thirty Years' War, and gained lands from Germany both on the Baltic and on the North Sea. In the time of Charles XI., Sweden gained Livonia from Poland, and, as we have seen, extended her borders to the extreme south of the Scandinavian Peninsula, which gave her ports beyond the narrow entrance of the Sound to the Baltic

THE SWEDISH KING WHO ASTONISHED THE WORLD BY DEFEATING THREE NATIONS

Charles XII. won victories which astonished the whole world. Attacked by Denmark, Poland, and Russia, all at once, he defeated all three, though at last he was defeated by the Russians. His reign was nearly all war, and the kingdom was taxed beyond its strength to provide men and money. Still, though it lost a great deal in later reigns, it has always kept its valuable gain from Denmark on the south of its own peninsula. Wars with Russia followed, and many revolutions took place. Kings and nobles claimed absolute power in turn.

During the Napoleonic Wars, Copenhagen was twice bombarded by the British, and the Danish fleet was seized. After the seizure of the fleet, Denmark definitely placed herself on Napoleon's side. Sweden took the part of the allies, and its crown prince, Bernadotte, one of Napoleon's generals, who had been elected by the Swedes to succeed their childless king, led the Swedish troops against his old master when, in 1813, all Europe was struggling to regain freedom. When peace was made, it was arranged that Denmark should no longer be united with Norway, but that the two kingdoms of the great Scandinavian Peninsula should be joined together under one king. To this the Norwegians strongly objected; they chose a king of their own, and set up the freest constitution that is possible with a king. In the end they had to accept the union with Sweden, joining as an independent kingdom, to be ruled according to its own free constitution.

NORWAY BECOMES AN INDEPENDENT NATION

But Norway ever kept the vision of independence before it, and in 1905 succeeded in its aims and separated from Sweden, choosing for its king a Danish prince who has taken the name of Haakon, so full of associations with early Norwegian history. His wife is a daughter of Edward VII. of England

THE PEOPLE OF SCANDINAVIA AT WORK

The fiords of Norway, with their deep waters and rocky walls, are excellent for fishermen, and such sights as this are common. The fisher sits in a "crow's nest," built on poles, from which he watches his lines or nets.

The people of Sweden make their bread in the form of flat cakes, which they call flat bread, and this is in many parts the principal diet of the people. In the picture on the left we see flat-bread being made in the open air, and on the right a farmer's wife and daughter are making and baking similar food in their kitchen.

Norway is not a leading agricultural country, its principal industries being timber and fishing. But agriculture has been much developed, and here we see a party of Norwegian haymakers at work in the fields.

and the crown prince bears the revered name of Olaf.

And now all three Scandinavian kingdoms are as independent of each other as they were at the beginning of their history; there was a century and a quarter of the Calmar Union of all three, nearly three hundred years of union between Denmark and Norway, and nearly a century of union between Sweden and Norway.

The Swedish crown has remained in the family of Bernadotte, who became king as Charles XIV., and improvements have been made in the Swedish constitution, and more freedom and liberty have been granted to other forms of religion besides the Lutheran. Sweden has universal suffrage.

After the Napoleonic wars, Denmark was so poor that she could not pay her debts. Gradually, however, the nation recovered. After a constitution had been granted by Frederick VII., the little country rapidly became prosperous, even though a large amount of territory was lost to her king when, in the war of 1864, Prussia and Austria took the duchies of Schleswig and Holstein. Prussia then took them, but after the Great War a part of the people chose to come again under Danish rule.

Six hundred miles away from Norway lies the large island of Iceland, many times larger than Denmark, to which it belongs. Settled by Norsemen in very early days, it was a possession of Norway when that country passed under Denmark. When Norway was united to Sweden, Denmark kept Iceland. The climate is so cold, and it is so difficult to grow food, that few people live there. Fishing is their chief occupation. Many visitors go in summer to Iceland to see the fine volcano, Mount Hecla, and the boiling springs, or geysers, near it. These are somewhat like those in New Zealand.

THE BUTTER FROM DENMARK THAT IS SPREAD ON BREAD FROM CANADA

Denmark owns, too, the mountainous Faroe Islands, midway between Scotland, Iceland, and Norway, where sheep feed, and wild birds circle round the tall cliffs, and the inhabitants live a primitive life. To Denmark itself, it is a very easy journey from England across the North Sea to the chief western port, Esbjerg, and then by train and boat to Copenhagen, on the east coast of Zealand, facing Sweden. This chief passage is called the Sound. Other passages are the Great Belt and the Little Belt, and lines of steamers are constantly plying between the islands and to the German coast, and by the great canal from Kiel Bay to the mouth of the Elbe.

For centuries, Denmark owned three of the West Indian Islands. In the year 1916, however, the United States offered to buy them for the large sum of $25,000,000, and after much discussion and many delays the sale was made, as we read on another page.

In the year 1915 a new constitution was passed by the Danish legislature, and became law in the following year. Under this, the country has universal suffrage, and not only can women vote, but may also be elected to the Thing, which is the ancient name for the legislature.

Denmark is one of the most famous countries in the world for dairy farming; the meadows are so rich, and the people are so careful and progressive in their methods, that their butter is excellent. Large quantities are exported. Many Danes have gone to Siberia, where vast farms are gradually being developed. In England Danish butter is used with bread made from the wheat of Canada.

Copenhagen, the haven of merchants, has very fine harbors and quays, and has been the capital of Denmark for many centuries. The popular King Christian IV. added greatly to its importance, and it has very interesting museums and picture-galleries. In the Danish Museum are collections of both prehistoric and historic objects, which illustrate the history of the country and its people.

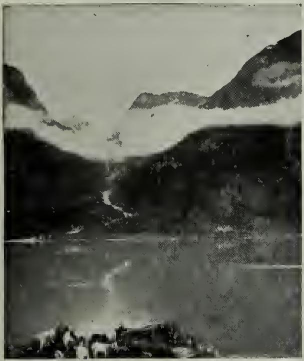
A DANISH AUTHOR WHOSE TALES DELIGHT THE CHILDREN OF THE WORLD

The porcelain factory is famous for its beautiful work. Among the statues of men held in remembrance by Denmark, such as Christian IV. and Frederick VII., who granted the Constitution, is that of Hans Christian Andersen, the friend of children throughout the world, whose beautiful fairy stories have been translated into many languages.

Copenhagen has one monument which is of peculiar interest to many of the countries in Europe. It was erected to commemorate the golden wedding of Christian IX. and his wife, and shows pictures in relief of the departure of their second son to ascend the throne of

THE GLACIERS AND FIORDS OF NORWAY

The famous Jostedal glacier in Norway, after winding about as shown here, is said to discharge into the waters of the Sogne Fiord, together with its ice, no less than a thousand tons of gravel and stones every day.



In Switzerland glaciers form amid crests and sharp peaks, while in Norway they are born on lofty tablelands. On the left we see a glacier on Lake Olden, glittering among the drifting clouds, and on the right the winding road of Griotlid. In the middle tourists are snowballing in midsummer on the Kaukeli Mountains.

Norway is noted for its fiords, or deep inlets of the sea, that penetrate far inland. The Geiranger Fiord is a typical example, and large steamers can navigate the narrow channel between almost upright walls of rock. The waterfall on the right is known as the Seven Sisters because there are seven streams of water.

Greece as George I., and the marriage of two of their daughters. It is a curious and interesting fact that, a few years ago, the rulers of the British, the German, and the Russian empires and the kingdoms of Greece and of Norway were closely related to Christian X., the present king of the little country of Denmark.

We cannot leave Denmark without a visit to its older capital, Roskilde. It is now an important railway centre. Of its ancient glory, the cathedral is the sole relic, containing the tombs of the Danish kings from the tenth century. That of Christian IV. is in a handsome chapel. It is but a short journey of three or four miles across the narrowest part of the Sound to the part of Sweden so long held by the Danes. Within view of the Swedish coast, a column on a hill is pointed out as the tomb of Hamlet. The story of this prince of Denmark was taken, as we know, by Shakespeare for one of his greatest plays.

A FAMOUS SWEDISH CANAL CUT OUT OF GRANITE BY A SCOTTISH ENGINEER

If we cross from Helsingor to Helsingborg, we can pass on to the mouth of the Gota Canal at Gothenburg, on the Kattegat, the chief western port of Sweden, and steam by it and the great lakes of Wener, Wetter, and Maelar right across the south of Sweden to Stockholm and the Baltic beyond. The journey can be done in twelve hours by rail, but the trip of two or three days by steamer is most interesting and delightful. The great kings of Sweden, Gustavus Vasa, Charles IX. and Charles XII., all planned to build this canal, many of the locks of which are cut out of solid granite. It was a Scotsman, Thomas Telford, a great engineer, who made the plans from which it was built in the nineteenth century.

This southern part of Sweden is the richest and most thickly peopled. In the clearings of the forests, crops such as rye, barley, oats, roots, and wheat are grown, and there is much dairy farming. North of the lakes of Wener and Maelar is the great iron-mining district. Swedish iron is particularly good for making steel; copper is abundant in the country, besides many other useful metals.

STOCKHOLM, THE VENICE OF THE NORTH, A CITY BUILT ON ISLANDS

Stockholm, the capital of Sweden, is most beautifully situated on the short river which forms the outlet of Lake Maelar. It is often called the Venice of the North. Perhaps the splendid quays, where ships are constantly loading and unloading, first attract a stranger's admiration, but it is equally delightful to watch the little steamers carrying passengers, as street cars do in ordinary towns, or to sit in the open squares watching the bright and picturesque figures as they pass. The museums are very fine, too; we can see the shirt worn by Gustavus Adolphus at Lützen, and many other relics of the hero-kings. The massive palace is of great interest, also the ancient church, which has been the burial-place of the Swedish kings and heroes since the time of Gustavus Adolphus.

The Deer Park is the most beautiful of many parks in the neighborhood, and the excursions all round Stockholm, on Lake Maelar and in other directions, are most charming. Dalecarlia, a district famous for its copper-mines, and its connection with the romantic story of Gustavus Vasa and his hairbreadth escapes, is also celebrated for the picturesque costumes of the peasants, whose snowy-white sleeves and black dresses, with stripes of bright color on the skirts and aprons, look very gay when numbers are seen together, as on Sundays and holidays.

Upsala, to the north of Stockholm, is a famous university town, and great is the scene of excitement when degree day arrives. Hundreds of graduates, in their white caps, throng the streets.

THE LAND WHERE THE SUN SHINES ALL THROUGH THE NIGHT

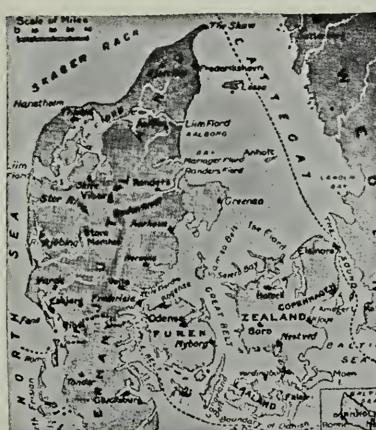
The singing of the students' songs is superb. It was Gustavus Adolphus who endowed this university with his private fortune; and there are many interesting links with the past, from the old pagan days onwards, in this city so dear to the Swedes. Education is very advanced in Sweden, which is famous all over the world for its fine system of gymnastics.

If we are in North Sweden between June 17 and 21, we shall have no real darkness at night, only twilight for about three hours.

It is a fine trip of three days to steam to the north of the Gulf of Bothnia, from Stockholm, towards the land where the sun shines all night. If the wind is off the Swedish shore, forests of pine and the meadows of endless farms send their sweet fragrance out to sea. We shall see many fishing-boats along the shores and

amongst the islands, and so many rivers glide into the sea, after their gentle journey from the snowy mountains, that the water becomes almost fresh, which is one reason why the Baltic freezes readily—the ice is not all gone even in June. Sometimes saw-mills, farms, and villages come in sight, and the steamer stops at many piers for passengers and goods. The twilight becomes ever shorter as we go north, till at last, on reaching the Arctic Circle, the sun remains well above the horizon all night. It seems very strange to see butterflies flitting about, to listen to the birds, and to gather wild flowers—all in sunshine at midnight!

It is a great time for the people who live in the land of the midnight sun when the sunshine comes to stay, and the ice breaks; they can open up communication with the south, and the rivers then bring down the trees that have been cut in the long winter twilight, when the sun never appears, and they depend on the wonderful aurora and the brilliant stars and moon.



THE DANISH PENINSULA

There are many lines of railway, especially in the south and middle of Sweden, and they also cross, in places, by the valleys through the mountain chain to Norway; but if we wish to travel by land in remote parts, and within the Arctic Circle, we must go by the small two-wheeled carts for which farmers supply horses and drivers; or we can travel by boats on the rivers, for many of them are navigable. Round the head of the Gulf of Bothnia, and reaching to the Arctic Ocean, is the land of the Finns and Lapps, the descendants of the old people driven northwards by the Teutonic Scandinavians. The Finns are farmers; strange farming it seems to us when seed, sown at the end of May, grows and ripens so quickly under the constant sunshine that the crops can be gathered in seven or eight weeks, before the shades of early winter approach. The Lapps hunt and fish, and move about with their herds of reindeer. Some of the rich Lapps own 3,000 of these useful animals. People who travel in winter, in these regions, have to depend on them to draw a sleigh over the ice and snow, and stormy and terrible it can be in the heights and dreary plains, as the people journey on business to distant fairs and markets.

But we are on our way, in the height of the beautiful Arctic summer, to the North Cape, on the island of Mageroe, the most northern land in Norway, and in Europe. Having crossed the strait, and climbed to the rocky plateau, nearly 2,000 feet high, we can stand at midnight looking north over the dark-blue Arctic sea, with nothing between us and the mysterious frigid region of the North Pole except an icy wall.

And behind us, fast asleep, lies all Europe — the northern peninsulas, the low countries, Germany, France, Austria, and the three southern peninsulas, with their blue and golden Mediterranean shores.

From the North Cape we come by boat to Hammerfest, the most northerly town in the world, all built of timber, and with churches, and schools, and electric light, and telegraph. The curious fish-like smell is from the cod-liver oil which is made in great quantities, and all along this coast fishing fleets are busy for many months in the year. The sun does not set in Hammerfest from May 13 to July 29; and he does not rise from November 18 to January 23. In these regions cows and sheep have to learn to eat fish, so scarce is their usual food.

As we pass southwards, noticing the rocky Lofoden Islands, along the grand coast, carved out by the ice plough of glaciers from the mountains behind, and the ceaseless wash of the Atlantic and the rains it brings, the scenery becomes less bare and dreary. Even in winter, the ports are free from ice, owing to the warm west winds and the warm current of water that flows across the Atlantic from the Gulf of Mexico. Among the innumerable beautiful fiords of Norway's long coast, from which the men of the

creeks put forth to sea, there are four that stand out for size and grandeur, and for historical interest. They are Trondhjem, Sogne, Stavanger, and Christiania fiords. Trondhjem Fiord is very beautiful with its rich vegetation, and its town of Trondhjem, formerly called Nidaros. It is called the cradle of the kingdom of Norway. For here the kings of Norway have been crowned since early days. Here the famous *Thing*, or meeting of the people took place; here St. Olaf was buried, and hosts of pilgrims were attracted to his shrine. The cathedral of Trondhjem is the finest of all the churches of Scandinavia.

As we see on page 3654, it was on the coasts between Nidaros, now Trondhjem, and Bergen that the great civil wars raged in the time of Sverre. The Sogne Fiord, a little north of Bergen, is the longest of the Norwegian fiords, over a hundred miles, and bare rocks are succeeded by narrow banks of smiling fields and orchards, and these again by sheer heights over 5,000 feet, over which the rivers pour from above. The largest glacier in Europe is found at the head of the Sogne Fiord.

Bergen—the pasture among the mountains — besides being of great interest from association with the old kings who lived and fought in it, and from its connection with the Hanseatic League, is the greatest fish market in Norway. It is a grand sight when the first of the northern seafarers arrive with their early boatloads of fish.

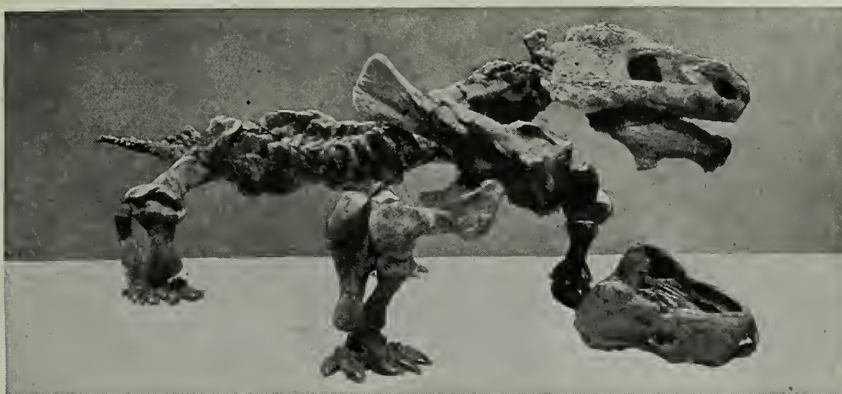
Yet another great fiord is Stavanger, with scenery as grand as that on Hardanger. The town of Stavanger is very old, and has a fine cathedral, dedicated to St. Swithin, Bishop of Winchester. By the quays here, we see steamers from Newcastle, Hull, Rotterdam, and Hamburg, besides the numerous boats that ply all along the coast, in and out of the fiords. For there are but few railway lines or good roads in these parts of Norway. The people go to church, to market, to school, all in boats.

NORWAY, SWEDEN, AND DENMARK

Christiania, the capital of Norway, lies at the head of the beautiful fiord of the same name near the borders of Sweden, founded, as we see on page 3655, by Christian IV., near the site of the old town of Oslo, where his sister Anne married the Scotsman, afterwards James I. of England. The trade of Christiania gives an idea of the resources and work of the country. From its docks and quays are despatched timber and ice, packing paper and paving stones, besides herrings and beer. Engine works, nail factories, shipbuilding, cotton mills, are all busy and noisy round about the capital. Among the many interesting things to see in Christiania, illustrating the history of Norway and the life of its people, are the two vikings' ships, in which the old chiefs had been laid to rest with their arms and treasures, just as the old Germanic kings were buried in their war chariots. With the actual timbers and the mast where the square sail was raised by a pulley, and the open spaces for the oars, all before us, it is easy to add in imagination the shining dragon's or bird's head on the prow, and the stalwart men with their flowing hair, and shining spears and shields, as they swept out of the beautiful fiords.

During the Great War the Scandinavian countries remained neutral and were unhappy. The Allies interfered with their trade with the rest of the world, and Germany sank their ships and threatened to invade them.

THE NEXT STORY OF COUNTRIES IS ON PAGE 3721.



This is the skeleton of a reptile that lived millions of years ago, and was one of the first creatures to live entirely on land. It was found at Cape Colony, but similar remains have been dug up in Russia.

NATURE'S GREAT FAMILY

CONTINUED FROM 3537

WE come at last to the end of our stories of the animal world. None of us are foolish enough to suppose that we have studied all the living creatures of the world. To write of them we should have to make many books. It would be impossible, at this stage of our study, to view the whole field of Nature. Nobody knows *all* about the living things of the world. The farther we go, the more we realize how very little we really do know. Great men find the study of animal life so difficult, that they are content with a knowledge of things in general, and are happy if they can call themselves expert in some particular branch. That is the only way in which we can get knowledge—to have men who will devote their lives to study and research, each in his own particular branch.

What we have been doing is to take peeps at scenes scattered far and wide over the world, and we have seen the creatures in them—some great and fierce, some merely huge; others of great service to man, others among his enemies; others, again, among the things which help to gladden the world with beauty and with melody.

We have only peeped. Nowhere has there been time for us to go into the heart of a subject, and make ourselves completely masters of it. Let it be hoped that what we have seen and learned has made us all the more anxious to search deeper into the mysteries and beauties of Nature. We can all be naturalists if we will. The country boy has a world of animals ready for him to study, if he will but look about him. The child born and reared in the town, if he will but go into a park or garden, may find on every hand material for the happiest, healthiest study.

But with what impression does our study of the animal world leave us? What are we to think of Nature's great family, of which we ourselves are but a part? We see that we ourselves *are* truly part of the great family, and it makes us ponder deeply.

We have seen how wonderfully some of the animals resemble us. We have seen that the man-like apes are shaped as we are shaped, except for a difference between our hands and feet and theirs. We are not to believe that we are descended from monkeys, because that is not true. That never has been seriously put forward by men who understood the question. We are taught by some great scientists to believe that we descended, or, rather, *ascended*, from creatures from

which the monkeys also descended. Far, far back in time, there existed creatures whose descendants became on the one side men and women, on the other side monkeys.

The Bible story is true, but the Bible does not teach science, and it must be read intelligently in the full light of truth as we know it. When we read that God made the world in six days, we must remember that the word "day" is only man's word. Moses—who is believed to have written some of the Psalms—sang: "A thousand years in Thy sight, O God, are but as yesterday." What we call days, the days in which the world was made, may have been ages too long for the human mind to understand. Man would pass through very many stages before God made him perfect.

Therefore, according to this theory, the creatures from which God ordained that man should spring shared the common lot of all other creatures. It seems hard to believe that men and women could have descended from a form of animal life which gave us apes and monkeys; but that is not harder to believe than that the lemur and the great gorilla descended from the same parents.

THE SOUL, THAT MAKES MAN THE LORD OF ALL CREATION

The lemurs were the first of all the monkey tribe. The lemurs are our very distant cousins, and so are the powerful gorillas. The chief difference is that God gave man a soul; He ordained that man, in his final form, should be the lord of creation. Animals have not souls. That, at any rate, is what men believe, though, when we see a bad man and a faithful dog, we feel it a shame that the brutal man should have a soul, and that the animal should not.

There is a wide gap between the lowest forms of human life and the highest forms of animal life, but there is a wide gap also between the highest and lowest forms of human life. Let us think of one of our great scientists, say, of Pasteur, whose studies of animal organisms resulted in the saving of thousands of human lives; or of a great musician or painter, whose melodies and pictures uplift the hearts and minds of men and women in every civilized land; then let us think of a band of cannibals, and let us ask ourselves: Can these great and noble men really belong to the same race as these horrible creatures? Let us think of Ruskin, and the influence he has had upon the English-speaking people; then of the degraded men among whom Livingstone lived, and worked, and died.

THE LOWER MEN, WITH LESS LOVE THAN THE HIGHER ANIMALS

They killed and ate one another with as little fuss as we should pluck and eat an apple. If one of them wanted to tie the tail of a gaudy parrot in his hair, the customs of his tribe compelled him first to kill a woman; if he wanted to wear the skin of a certain animal, he must first kill two or three of the people about him.

The natives of Tierra del Fuego, whom Darwin described, were superior to the animals, for they could light a fire and use tools; but they had not as much love for their families as the apes have for theirs. One of the men was seen to dash a child down upon the rocks and kill it, because it had happened to slip, and let fall some sea-birds' eggs. Even a gorilla loves its little one, and will defend and tenderly rear it. But these savages, when winter came, and food was scarce, used to take their old women and kill and eat them. Yet once upon a time these people had probably been far higher in the scale of human civilization.

They had wandered down from the mainland of South America, where human society was well advanced. It is worth while to study an instance of this sort, for it shows us another side of the picture at which we have been accustomed to look. We have been in the habit of seeing how man and animals have progressed; but this case enables us to see how, in certain circumstances, man can degenerate. Miserable and evil as they were, these savages were the same in form and soul as the rest of us who are living in happier lands.

HOW NATURE IS EVER IMPROVING HER CHILDREN

Nature is the wisest of mothers. Everything in her home—which is the world—moves in due order, without hurry, without error. First, there were created the simplest forms of life, plants, and jelly-like things in the sea, and tiny things which we call infusoria. The infusoria have not changed. We know all

about them from reading their life-story on page 2405. They are the same in form and character to-day as they were at the beginning of time. All through the ages they have been a constant food supply to multitudes of animals which have developed and become more important in the world. Things which started from the same place in Nature, from the same elements as the infusoria, developed in slow process of time into monstrous animals; but the tiny infusoria retained their first form.

A single infusorian, of itself, is of no account, but after a week of life it will have become the parent of a hundred billion infusoria. And every infusorian of that tremendous total—200 pounds in weight—is of importance to us, not only because it may serve as food for animals, but because, with other still smaller organisms known as bacteria, it eats decaying substances. So that the tiny infusoria are of more importance to the world than the lordly elephant or the majestic lion.


A FULL-GROWN GORILLA

From the same elements which formed the infusoria and other tiny things, there gradually grew up the true jellyfish, the lovely sea anemones, the wondrous corals, and the things in the sea that sting. Already Nature had begun to arm her children, we see, by giving them stings. Next came worms, leading on, in one line, to other worms. Along another line there developed the sea urchins and sea cucumbers, the starfishes and the brittle-stars and feather-stars. While these were growing up along one line, in another line the crustaceans began to develop; and at the head of their line came the insects, appearing in the world at the same time that, along the other line, gasteropods, things like whelks, and so forth, came into being, followed by the cuttlefishes. Little by little, new forms of life were thus appearing in the sea and there were, so far, no living animals on the land. Then came two important changes. On one hand came the lancelets, and on the other the tunicates.

They grew out of a lower form of sea life, and seemed likely to become a good deal higher, but they did not quite manage it. The lancelets remain to-day just where they were millions of years ago, when they first assumed their new form. They almost became true fishes, but they stopped just short. The lancelet remains still a small, almost transparent "fish," living on the sands along the seashore or at the mouths of rivers, and has gone no further in life's progress. There must have been many forms like it when the upward move first began, but the lancelet settled its form after a struggle, and has never departed from it. The members of the family which improved themselves passed up higher, stage by stage, in their family history, and perhaps to-day we might find among the humming-birds and the ostriches descendants of what, far, far back in the ages, were once things very much like lancelets. The tunicates, after having progressed a long way from the life-forms below them, stopped short. They were meant to go higher, along with the creatures that set out with themselves in the race of progress. The tunicates, from age to age, have been promising, as it were, to become something higher. They were near to becoming the first backboned animals, but they have always failed to fulfil their promise. The young ones seem decidedly to rank with the backboned animals, but when they grow up they fall away like the rest, and show no more backbone than a jellyfish. These two forms of animal life remain to-day as they were millions of years ago, to show us in life what we should have otherwise to seek in fossil form,

the character and nature of the things out of which the higher forms came. For, from the lancelet stage there grew up the real fishes. We see what the first types were like, because the tunicates, the lancelets, the hag-fishes and lampreys, which are not fish at all, are with us to-day, to tell the story of life unchanged. True, they live in the waters of the sea, but they have no jaws, no limbs, and no scales.

THE FIRST CREATURES TO HAVE BACKBONES AND JAWS

The fishes marked a very important upward stage. They were the first of all animals to develop backbones and proper jaws, that gave them a great advantage over other forms of life, and caused fish to take different characters. Fish took to eating fish. Those fish which had the stoutest armor of tough scales would have the best chance of escaping their enemies, and of getting less protected fish to eat. For a long time the bony fishes, the ganoids, as we call them, flourished exceedingly, with their powerful framework of bone and their heavy armor.

The other fish, the fishes whose framework is mainly composed of cartilage, must have had a bad time of it for a long time with these bony-armored monsters. But there we get the first lesson in the history of the animal family of the uselessness, in the long run, of special protections of this sort.

Sheer weight and strength of armor never, in the long run, carry any class of animal life to success. In the case of the fishes, it was those with the softer skeletons that triumphed. Of all the multitude of bony fishes that once peopled the seas, only seven different kinds remain alive to-day, while those less specially protected abound in countless varieties. Let us keep this fact in mind for a few moments, to remember it when we come to the higher animals.

HOW ANIMALS GREW LUNGS AND LEARNED TO BREATHE

The next stage was for the animals to learn to breathe the air of the atmosphere—a most tremendous stride. They had to develop lungs as well as gills. Gills enabled them to breathe by taking oxygen out of the water that coursed over their gills; their lungs enabled them to poke their noses above the water, and to drink deep of the air that, later on, man himself was to breathe. Man himself, in his early form, was a creature who had gills, to breathe in the water as the fishes breathe. The mud fishes, of which we read on page 224, are still with us, to show how fishes that have gills may also breathe by the aid of lungs, as human beings breathe.

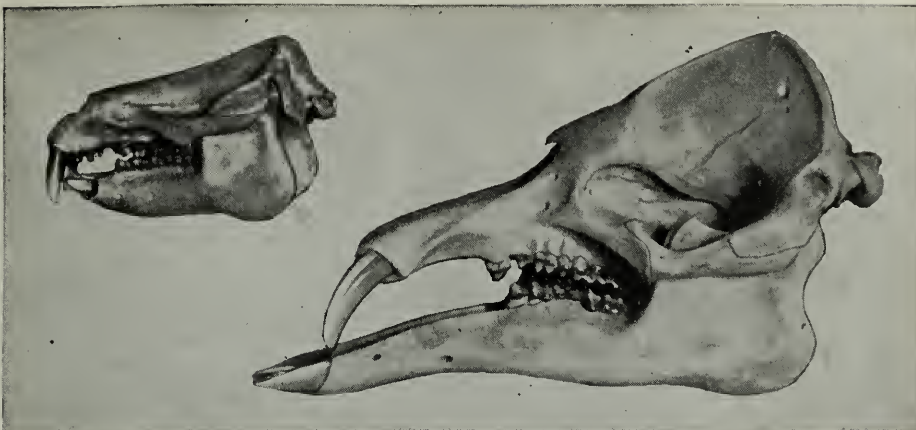
While the fishes were mastering these two sorts of breathing, there grew up, from the tunicate side of the family tree, the first amphibians, the creatures which begin their lives in the water, and end by coming to land. Newts and frogs must have been among the first creatures in all the world that ever set foot on dry land. Of course, newts and frogs did not soon reach the form in which we see them to-day. When we read, as on page 1223, of the various stages through which the frogs and newts pass from their baby days to their grown-up days, we see just the stages which they passed through during ages and ages. They now run through all these changes in the course of a few weeks, but in olden days each stage would last while thousands of generations of frogs and newts lived and died.

THE DAYS WHEN THERE WERE GIANTS ON THE EARTH

Then, when the fishes began to breathe the upper air, and amphibians began to disport themselves on land, the animal family underwent great changes. The world came to the age of reptiles. Snakes were created from the lower creatures, and with them appeared the crocodiles and tortoises, and those fearful monsters of which details and pictures are given on page 50. That was indeed an age of giants. We have not time to go again into their history; we may very well turn to page 52 and the pages which follow, and refresh our memories with the stories there set out; and the pictures will help us to fix in our minds the figures of some of the fearful and wonderful creatures which, in those days, became masters of the world before ever man had been created.

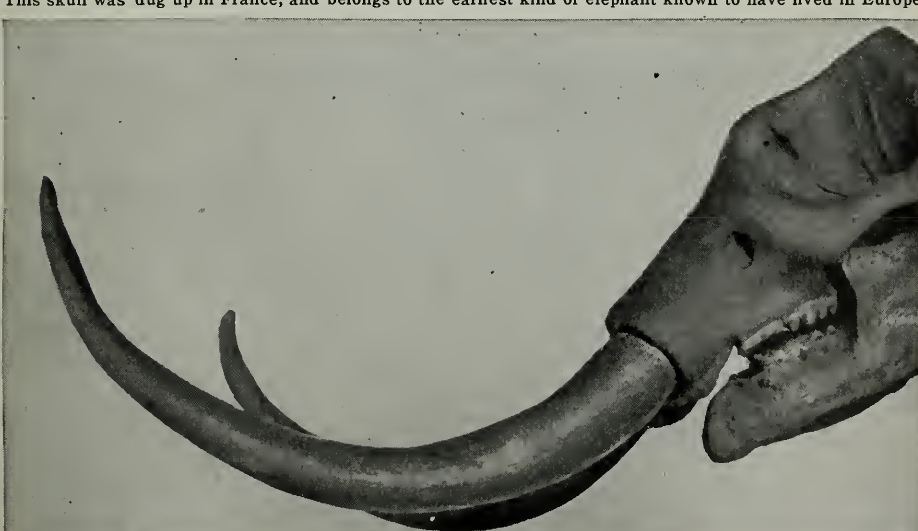
We are bound to notice how the way was prepared for these monsters. Insects by this time abounded, and they had taken to leaving the water, in order to escape from the giants which fed upon them in the seas and rivers. The

HOW THE ELEPHANT GOT HIS TUSKS



Elephants are now found only in India and Africa; but in past ages they, and other creatures like them, roamed all over the northern hemisphere, even in the Arctic regions. Here are the skulls of two ancestors of the elephant, the moeritherium on the left and the palæomastodon on the right. They were dug up in Egypt.

As the ages went by, the creatures with tusks and long noses became more like the elephants of to-day, and in this picture we see the skull of the tetrabelodon, a later animal than those whose skulls are shown above. This skull was dug up in France, and belongs to the earliest kind of elephant known to have lived in Europe.



This skull was found in America, and belonged to the mastodon, a kind of giant elephant, that roamed over Europe and North and South America a million years ago. These skulls, which are in the Natural History Museum in London, show how the elephant's tusks have come by gradual lengthening of the cutting teeth.

insects, in those early days, grew and developed like all other things, and some of them were as big as chickens. They fled to the land, and the animals followed them, some of them to catch the insects, some of them to eat the plants which by this time flourished on the earth; some again to eat the creatures which fed on plants or insects.

HOW CREATURES LEARNED TO FLY AND LEAP AND CLIMB

We may very well believe that the desire of the insects to get away from their enemies first drove them to land, and then gradually led them to form habits of flying. The reptiles which fed most on insects would now find it more difficult to catch them. The reptiles would climb about the trees after the insects, and, like the flying phalangers, and other so-called flying animals of to-day, would learn to take leaps from tree to tree, and from branches to the ground.

And they must have gone on doing that for ages and ages, before the first real bird came into being. The first bird was a curious animal, with a great beak which had teeth in it, with a tail fleshy, and long, and jointed like a lizard's, and with feathers growing out from the joints. It must have been a horrible-looking thing, with its lizard-like body and frightful toothed beak. But that nightmare creature was the father of all the birds that now inhabit the earth, and it was evolved from reptiles which had fishes for ancestors.

While the birds were growing into shape, a very important development was taking place in another direction. The mammals made their appearance. The mammals, we remember, are all the creatures which feed their young ones on milk. Elephant and squirrel, whale and mouse, seal and cow, wolf and walrus, lion and llama—these, and the rest like them, are mammals. The class began in the strangest animals, of which the echidna and ornithorhynchus, or duck-bill platypus, are still living with us, to tell us the romantic story.

THE ANIMALS THAT LAID EGGS AND PUT THEM IN THEIR POCKETS

The animals branched off from the reptiles where the birds began, and it must at one time have seemed a chance whether they would be four-footed animals or birds. They laid eggs, but fed their young ones on milk. Some carried their eggs in pouches, as the echidna carries hers, and as the kangaroos and other pouched animals carry their young ones to-day. They were the first of the mammals, and it makes us hold our breath to think that we may still see representatives of these earliest mammals alive to-day, unaltered from the kind which first gained permanent shape, millions of years ago. From this great change in the animal family all other mammals, whether flesh-eating, insect-eating, or herb-eating, came into being.

After the monotremes—that is the name of the first mammals of which we have been talking—came the marsupials, the kangaroo-like animals. Next came the edentates, animals with no teeth, or very inferior teeth, among which was the gigantic megatherium, whose family is represented to-day by the sloths, the ant-eaters, the armadillos, the aardvarks, and so forth. With these there came into the world the sirenia, which sailors to-day call mermaids, and after these the great whales that live in the sea.

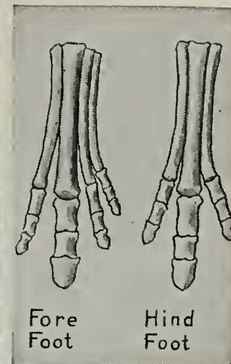
GREAT AND FIERCE BEASTS THAT ONCE ROAMED IN THE UNITED STATES

The insect-eating animals seem to have been followed by the rodents—the animals that gnaw. Then came the lemurs and bats, followed by the great flesh eating mammals and the ungulates. The latter class give the world some of the most, indeed its *most*, important animals. The ungulates are the hoofed mammals. They include the pig, the peccary, the hippopotamus, the camel, the cattle, the deer, the sheep, the tapir, the rhinoceros, the horse, and the elephant. Of course, they were not like the creatures that we know to-day.

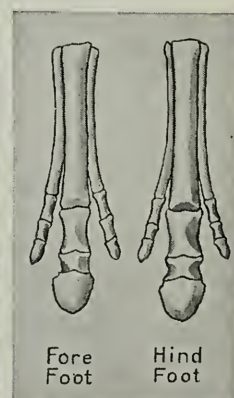
The mammoth and the mastodon were alive when man first appeared on the earth—the mammoth was living in America when the first men appeared here. The first horse was a little five-toed creature, which needed its many-toed, outspread feet for the marshy country where it lived, just as much as the camel needs its broad, expansive foot for making its way over the yielding sand of the desert. The monkeys came last, and after these the highest of all God's great family—man.

It will be as well to turn back at this point to page 632, and read again the wonderful story of the lemur, which was

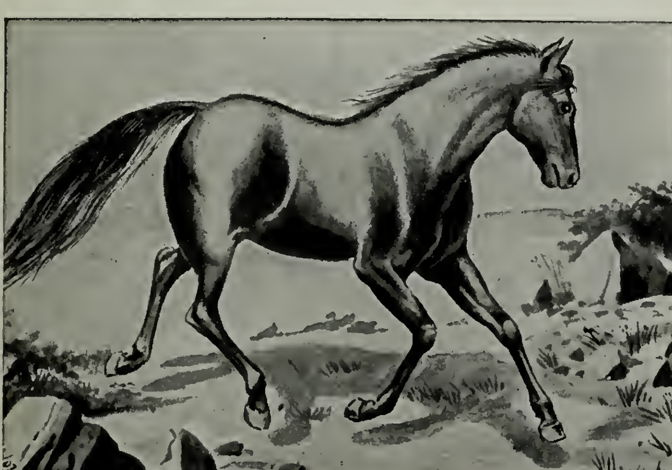
HOW THE HORSE BECAME STRONG & SWIFT

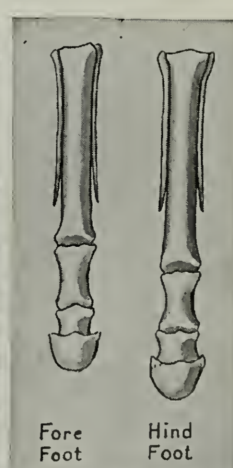


Hundreds of thousands of years ago, there lived some little animals like the creatures shown in this picture. They were about the size of a fox, and had feet something like a hare. They were not very strong, and soon learned that, when enemies were about, the best thing to do was to run away as fast as possible.



As centuries went by, these little animals changed. Each generation was a little stronger and larger than its parents had been, and after thousands of years the creatures became like those seen here. Constant running away from danger had made its legs grow longer, and its feet became like hoofs, as we see by these bones.





When still more thousands of years had passed, the little creature that was once only as large as a fox and had feet like a hare had changed completely, until it had developed into the noble and swift horse. All the toes but one had disappeared, or nearly so, and the one that remained had become a thick, strong hoof.

the father of all the apes and monkeys. Some men believe the first of man's family sprang from the stock which gave the world the lemur. We need not go deeply into the question here, it is a matter for later study; but we must not pass away from it without a word in closing our story. The first men were high-shouldered, short-necked, long-armed, with slightly bowed legs, hairy, and with big teeth and yellow skin. They were wild and savage as the beasts of the field.

These are deep waters for young people to swim in, and we need not venture farther from the shore. We do not *know* all these things about the origin of man; some men believe these to be the facts. The real story can never be fully told, until the great day when all secrets are made known to man. They infer these things from similar evidences to those which help us to find out the story of the rest of creation. We do not know how long man has lived on the earth; some say 100,000,000 years, some say 20,000,000 years, some say only 30,000 years.

MEN WHO WERE CIVILIZED TWENTY THOUSAND YEARS AGO

We know that man has lived very much longer on the earth than the old teachers believed. We may still find printed books giving the date of the beginning of the world as only a little over 4000 years before the birth of Jesus. Yet as recently as the year of 1909 men found, in a city long buried, traces of a high civilization, and a great population, that existed 20,000 years ago, it is believed.

It is certain that of all the great advances made in the animal world, the advance made by man is the most marvelous of all. Every page in this book tells of the marvels that he has done. The natural thing to believe and hope is that man will continue to improve in the future as he has improved in the past, when, in obedience to the will of his Creator, he appeared upon the earth, and, by gradual stages, followed the path set before him, to become the wonderful creature he is to-day.

And so we end as we began, by trying to realize that every form of life in the world is related. We are such stuff as birds and animals, and reptiles, and trees, and flowers are made of. There are the same elements in the worm as in the rose, in the child as in the tiger. But the mind of a child is something greater than anything the tiger has. It is not the thickness of armor nor the power of weapons that count for all time in the great battle of life.

MAN, WHO IS THE MASTER BECAUSE HE USES HIS BRAIN

Man is the weakest, so far as mere strength is concerned, of all the great animals of the earth. An ox could crush him; he would serve only for a single meal to a hungry tiger. But, though he is of the same substance as that of which they are made, he is their master. He has hands to use, and a brain to direct them. He makes tools that are almost as wonderful as his hands that create them. He has always had to use his brain for his living.

The giant reptiles and giant flesh-eating animals did not use their brains as man used his. They developed enormous bodies and amazing armor, but they did not develop their brains. Fearful weapons armed the sabre-toothed tiger, but the tiger that used its brains more and its sabre-teeth less still survives, while its more powerful ancestor is numbered with the fossils.

The mighty glyptodon, with its shell like a hut of horn, is part of the solid rock, while the little tortoise still flourishes on a modest diet of lettuce, with a handful of clover flowers as a luxury. The pterodactyle, with its bat-like wings and with claws upon them for climbing, is as dead as the teeth which armed its jaws, but its fairy-like descendants, the humming-birds, sport like magic motion in the tropical forests. The bat flitters light and airy as ever, when the moon peeps out, though most of the companions of its earliest days on earth have died out.

THE MANY FORMS OF LIFE THAT ALL SPRANG FROM ONE SOURCE

The hideous ichthyosaurus is turned to stone, but the jolly dolphin sports as merrily in the waves as if his family were new to the delights of the great waters. If it is true that all living things sprang, in the first place, from the same source, and that all owe their presence on the earth, or in the waters, to the one universal kind of life, we feel a certain awe in the presence of any form of life.

THE STORIES OF NATURE ARE CONTINUED ON PAGE 3741.

When a thing is balanced, it is said to be in equilibrium. There are three kinds of equilibrium, as shown by these tops. That of the first is stable, because, if slightly tilted, the top returns to its original position; the second is unstable, because a slight push will send it over; and the third is neutral, because, if pushed, it moves, and then rests in a similar position in relation to the ground.

HOW THINGS ARE MEASURED

CONTINUED FROM 3592

ALL our ideas of motion are, as we can understand, relative—that is, something moves *compared* with something else. We cannot say in what direction, or at what speed anything is moving, or even that it is moving at all, except as compared with something else. If, however, we admit this, still it is possible that we may measure relative motion, and compare it with other relative motion.

It has often been declared that science is measurement, and though this is very far from being the whole truth, yet it is quite true that everywhere it is the business of science to measure, and that the value of our work will always largely depend upon whether or not we have measured correctly.

Now, in this important question of motion—which, as we have seen, comes into everything—there are, to begin with, two great kinds of measurement which we must employ. There is nothing difficult in understanding this, because we make a measurement of this kind when we say that a runner can run a hundred yards in ten seconds, or that it took us an hour to walk three miles. When we say things like this we are measuring *time* and *space*. In every kind of motion that we can imagine, whether of a runner, or of a star, or of the electrical particles inside an atom, time and space are concerned. As we shall see, there is something else also concerned, and that is *mass*, but we must begin with time and space. First of all we must have some way of measuring time, and, though we are very familiar with this nowadays, the hard work of a great many fine brains had been put into the subject before our watches and clocks were made possible. We have already learned the law of the pendulum, which gives us the basis for a clock when we so arrange that every time the pendulum swings it touches something and turns a wheel a certain distance.

We know also that there is a kind of clock in the pulse of our own bodies, and when we are in health the pulse beats almost as regularly as the pendulum. Some people have supposed that our idea of time begins with a faint sort of feeling in our own bodies, due to the beating of the heart and the pulse. But, of course, we want some bigger facts than these to base our idea of time upon, and the most convenient, apparently, are night and day. Though the periods of light and darkness are not constant, yet the turning of the earth

is constant. It is getting very slightly slower in the course of ages, because, as we have learned, the tides act as a brake upon it. But this is so slight that, for all our purposes, the length of the day is a perfectly fixed and constant thing. We divide this up into twenty-four parts, which we call hours, and these into minutes and seconds. The second, then, is the thing we reckon from, and a second is simply a sixtieth part of a sixtieth part of a twenty-fourth part of the time that the earth takes to spin completely round once.

A THING ABOUT WHICH THE WHOLE WORLD AGREES

It is one of the most fortunate of all possible things that the whole civilized world is agreed as to the second. We call it a unit, as if time could be cut up into little pieces, each of which is a *one*, or a *unit* of time. All over the world, then, the unit of time is the same. If anyone proposed that we should have a unit of time rather longer, or shorter, than a second in this country, or that the units should be different in all countries, everyone would be horrified. Once men are agreed upon anything, they can see plainly enough what a lot of unnecessary trouble it causes when they do not agree.

Now, it is a pity that our unit of time is about the only thing we *do* agree upon. Everyone who has begun to think about the subject at all knows that if only we had the sense to agree upon units of weight and space, endless trouble and labor would be saved. First, as to space. If we think of a solid box, we shall understand that it is possible to measure space in three directions, or, in the case of a flat thing like a sheet of paper, we can measure in two directions—though, of course, the third direction really comes in, for the paper has a certain thickness; or, if we can imagine a line that has no width, then there is only one direction in which to measure.

HOW A KING'S ARM BECAME A MEASURE FOR A NATION

But, whatever we are measuring, all we need is one, two, or three measurements of distance, and so we want a unit of length, or distance—something to correspond to the second, the unit of time. In this country, as we all know, our unit is the yard, which we divide up into three feet, each divided into twelve inches. The length of the yard is supposed to have been based upon the length of the arm of one of England's kings. There is really no particular reason why it should be as long as it is, for it is not based upon any natural distance, as the second is based upon a natural period of time, the time of the earth's rotation. Nor is there any reason why the yard should be divided up as it is, and there is still less reason why 1,760 yards should make a mile. To tell the truth, all the English measurements of distance, and the measurements of weight, which we borrowed from them, are needlessly complicated. They only make endless trouble, which does no good to anybody, and the time will certainly come when they will be all swept away.

The point is this. Because we have ten fingers we count in tens; therefore, for ease and quickness of reckoning, all our measurements should be in tens; then, in order to reckon, we should only have to use the very simple method which we learn when we study decimals.

THE MEASURE THAT IS USED ALL OVER THE WORLD

All over the civilized world now, men of science have agreed upon a certain kind of measurement which is not the English measurement at all; and in most countries the scientific way of measuring is also used for ordinary purposes too. Our merchants are often very seriously at a disadvantage, because they reckon in different terms from the rest of the world, and will not take the trouble to find out how the rest of the world reckons. If foreigners cannot count like us, they must be stupid, we think!

This new and sensible system of reckoning is called the metric system, from the word *metre*, meaning measure, which is its unit of length. We owe the metric system to the French. They wanted to get a natural basis of measurement, and so they measured the distance from the earth's Equator to the Pole, and took a fraction of that, and called it the metre. As a matter of fact, their reckoning was not quite accurate, but that does not matter.

The point is that all the other measurements are based upon the metre in tens. The length of the metre is slightly more than thirty-nine and a third of our inches, so it is more than three inches longer

than a yard. Then, in order to get fractions of a metre, or multiples of a metre, there are used all over the world, terms derived from Latin. For instance, the tenth part of a metre is called a *decimetre*, the hundredth part is called a *centimetre*, and the thousandth part a *millimetre*.

THE WONDERFUL METRIC SYSTEM THAT MAKES RECKONING EASY

This, however, only begins to express the simplicity of the metric system. The great point about it is that all the other kinds of measurement are calculated from the metre. For instance, our pints and quarts have nothing to do with our yards. But in the metric system all the measurements of bulk are based upon the length of the metre, and then the measurement of weight, or rather the mass, is based upon the weight or mass of a certain bulk, the size of which is derived from the metre. The consequence is that weight, and volume, and length, can all be understood in terms of each other in a moment, and the labor of reckoning becomes practically nothing at all. Thus, if an American man of science were now compelled, instead of using the French method, to do all his reckoning in inches, and grains, and pints, and so on, he would get about as much work done in a week as he now does in a day.

A good many sensible people want us to adopt the metric system generally in America, just as it is already adopted for science everywhere; and most of the children who read this will probably live to see the change made.

Now we have the unit of time, which is the second, and the unit of length, which is the metre; but when anything moves there is another question besides time and space, and that is the amount of stuff that happens to be moving.

THE MUDDLED SYSTEM OF WEIGHTS AND MEASURES THAT WE USE IN AMERICA

In this country we reckon in grains, and ounces, and pounds. These have no relation whatever to yards, or to inches, or to pints. A certain number of grains and ounces make up one kind of pound, and other numbers make up another kind of pound and everything is as muddled and stupid as it can be. So we can quite understand that men of science do not reckon in these ways. We want a unit of mass that is based on something, and, of course, we shall choose it in a simple, useful relation to our other measurements. This, then, is what we have done. We choose water because it is so familiar and important. Now, we know that water is at its densest, or most shrunken, when its temperature is four degrees above zero, or nothing, on what is called the centigrade scale. So we say that we shall use, as our unit of mass, the mass of one cubic centimetre of pure water at the temperature of 4°C. This unit of mass is known as a gramme. It is roughly equal to about fifteen of our grains. Just as in the case of the metre, we can divide the gramme into tens, and hundreds, and thousands, or multiply it in the same way.

The scale of temperature called centigrade—that is, "hundred steps"—is also based sensibly upon tens; *o* on this scale is the freezing-point of water, and 100 is the boiling-point of water. This scale is used by men of science all over the world, and for ordinary purposes, too, in many parts of the world. But in the United States we still stick to the Fahrenheit scale, though we have not even the excuse that it is an American invention. On this scale the freezing-point of water is 32, and the boiling-point 212. This is all we need say about it here, since it is never used in science.

WHERE A POUND DOES NOT WEIGH A POUND

We have sometimes used the word weight and sometimes mass. Commonly, weight is sufficient for our purposes, because weight and mass practically come to the same thing; but in reality weight and mass are quite different, weight being a consequence of gravitation, while mass is really the actual amount of stuff in a thing.

If gravitation ceased there would be no more weight, but the mass of everything would be unchanged. A pound of lead contains a certain amount of lead wherever it is; but it really weighs slightly more than a pound if you throw it into a ditch, and it weighs a trifle less than a pound if you hold it up in your hand, because weight depends upon gravity, and gravity depends upon its distance from the centre of the earth. On the moon the lead would weigh far less, on Jupiter far more, and on the sun still more, but the mass of the lead would remain exactly the same all the time.

Now that we have our units of time and space and mass, we can begin to put them together, and then they become very interesting. When we reckon time and space together, plainly we get the idea of speed—how much time was occupied in covering certain distances. In science it is common to take together the idea of speed and the idea of direction, and the word that is used is *velocity*.

Velocity means more than speed, for when in science we say that a thing has the same velocity, we mean not only that it is moving at the same speed, but also that it is moving in the same direction. Here, however, we need only think of speed, and need not trouble ourselves about velocity. Sometimes in Nature we find that speeds regularly increase, or regularly diminish. This happens, for instance, when a body falls under the influence of gravity, or when it is thrown up, and is slowed down, by the influence of gravity.

WHY IT IS DANGEROUS TO FALL FROM A GREAT HEIGHT

It has been proved that whenever anything falls to the earth under the influence of gravity, in each second of time it passes through thirty-two more feet of space than it did in the second before. This, of course, explains to us why it is more serious to fall from a great distance than from a small distance. If gravity simply pulled a body at a certain rate which did not change, it would hurt us no more to jump from a high tower than to jump off a chair. But what happens is that the speed of a falling body constantly increases, so that the farther we fall, the greater the force with which we strike the ground.

Of course, when we state this about the speed of motion under gravity, we assume that nothing interferes with the action of gravity. But we know that gravity is not the only force in the world. For instance, let us take the case of a raindrop. Suppose that a raindrop formed in the sky had to drop through empty space to the earth. In the first second it would cover not 32 feet, but 16, because, at starting, its speed would be nothing, and only at the end of the first second would the speed be 32 feet per second. So the distance covered in that first second would be one-half of 32 feet; in the second it would cover 48, and so on. If we knew the height from which it began to fall, we should know its speed when it reached the earth. If, also, we knew its mass, we should know the force it had in it at the end of its journey. But, in point of fact, a drop falls through the ocean of air, which is resisting it all the way, and which, fortunately for us, greatly diminishes its speed.

HOW THE AIR PREVENTS THE FALLING RAINDROPS FROM KILLING US

Were it not for this resistance, we do not know what would be the consequences of being struck by a raindrop or a hailstone. Recent work has shown that there is a limited speed which raindrops cannot exceed, because the faster they move the greater is the resistance of the air; and so at last they cease to move any faster. This, of course, would not be the case if gravity were acting without anything to interfere with it. People who study the speed of ships in water know that the same thing applies there, and that the faster the ship moves, the greater is the resistance of the water.

Gravity, as we have said, is not the only force in the world, but it is always acting everywhere upon everything. If, then, we find things at rest, there must be some other forces which are working to oppose the force of gravity. When we think of this, we shall see that we get a new idea of what we mean by rest.

Undoubtedly there is really no such thing as rest. Everything is continually moving, and it is moving under the influence of forces, such as the force of gravity—the table at rest on the floor is moving with the floor and the earth. But still that table is at rest as compared with the earth—relatively to the earth, as we say. And so, while understanding that there is only relative rest and no real rest anywhere, we must ask ourselves what rest means and upon what it depends.

THE FORCES THAT ARE NEEDED TO KEEP A THING AT REST

It might be thought that when we are studying motion, rest has nothing to do with our subject, because we think of rest as the opposite of motion. Yet that is not true. What we are really studying, whether we are looking at motion, or at rest, is the action of forces. Newton's first law of motion might just as well be called the first law of rest. It applies equally to both states. Whether moving, or at rest, a body is subject to

forces. If these forces are perfectly balanced in strength and direction, then it will remain at rest; if the balance is in the slightest degree imperfect, then it will move. Therefore rest, just as much as motion, is a question of forces.

This will help us to understand a new word—*equilibrium*. The word suggests the word equal; and when we study equilibrium, we are studying the condition of a body which is under the influence of equal and oppositely acting forces, and is therefore at rest. This is not an easy subject, but the elements of it are not difficult. We can easily find instances in everyday life which show that bodies at rest are not all in just the same kind of state; in other words, there are different kinds of equilibrium. This question is important not only from the point of view of the study of forces, but also because it deeply bears upon practice in the sailing of a boat or the flying of an aeroplane.

THE MANY WAYS IN WHICH A THING MAY BE AT REST

We say that a body is in a state of *stable*—which means stand-able—equilibrium when it resists attempts to disturb it, and if moved will actually return to its original position; that is, of course, if the force that moves it does not go on acting. A tumbler standing in a cupboard is in a state of stable equilibrium. If we attempt to tilt it, it will allow itself to be moved a considerable distance, and will yet return when we remove the finger; or, if we hang a weight from the end of a piece of string, we have a true case of stable equilibrium, no less than in the case of the tumbler, even though the least touch will set the thing swinging. The point is that the weight will always tend to return to its original position.

But an egg balanced on end is in *unstable* equilibrium, because, though it may be balanced for the fraction of a second, it cannot recover from the tiniest amount of disturbance. That is the mark of unstable equilibrium—that the very least possible disturbance, in any direction and however brief, is sufficient to destroy it.

There is another kind of equilibrium, neither stable nor unstable, which is called *neutral*, meaning that it is neither the one nor the other. A billiard ball at rest on a table is the best instance of neutral equilibrium. It is at rest; that is to say, the forces acting upon it are perfectly balanced. If now it be disturbed by a gentle push, it will move a little way and then come to rest again.

That is the proof that it is not in a state of stable equilibrium, because it shows no tendency to come back to its original position, unlike the weight hanging from the string. But yet it is not in a state of unstable equilibrium, because it does not continue to go on indefinitely leaving its original position, but does soon come to rest.

THE IMPORTANT LAWS OF MOTION THAT THE SEE-SAW TEACHES US

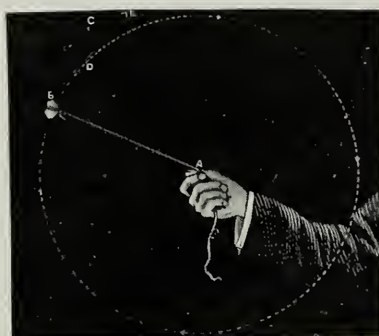
The study of rest very soon becomes highly complicated. For instance, let us take the case of a see-saw. It is possible for the see-saw to be at rest with a little boy at one end and a big boy, not at the other end, but half-way along towards the other end. The heavy weight on one side balances the lighter weight on the other side because the power of the two forces depends upon their distance from the point where the see-saw is supported; and these two downward acting forces—for the earth, of course, is doing its best to pull both the boys straight downwards—are exactly balanced by an upward force acting through the support of the see-saw. When we come to study the weights of the two boys and their distances from the centre of the see-saw, we find the one condition on which the see-saw can be balanced. This is one of the most important facts that we have to learn in this part of our subject.

THE DIFFERENT KINDS OF LEVERS THAT WE USE EVERY DAY

The see-saw will be balanced only when the weight of the one boy, multiplied by his distance from the centre of the see-saw, is exactly equal to the weight of the other boy, multiplied by his distance from the centre of the see-saw. This discovery explains to us the working of the various kinds of levers. When we look at the see-saw, we can see that the little boy at the end of the long arm, able to lift up the big boy on the other side, is acting like a lever. He is, indeed, acting just as a crowbar acts. The man working with a crowbar exerts a comparatively small force at his end of it, but does a great deal of work at the other end of it.

We can only understand how this happens if we think of the crowbar as a kind of see-saw, with a long arm where the man applies his force, and a very short arm on the other side. The same applies to pincers, which have long arms and short arms, as we know, and to nut-crackers, and to a man rowing a boat, and to a host of other things.

We can readily understand that often a moving object or a still one may be acted upon by two or more forces which are not perfectly balanced in opposition to each other. If they were, the moving object would be brought to rest, and the resting object would remain at rest. But if the forces do not exactly balance one another, then the thing which is being acted upon must move. But how will it move; in what direction, and at what rate? Can we possibly predict the course that the body will follow if two or more forces of different strengths are pulling upon it in different directions? The answer is that though this is a very difficult matter, yet the laws of motion are equal to the study of it. Each force has its own value, both as regards its power and its direction, no matter whether there be one other force acting or a million; and if we know the power and the direction of all the forces that are acting, we can say in what direction the body will move and at what speed. In other words, to use the special language of this subject, we can predict its velocity.



The tendency of a moving body is to go on in a straight line, and if the stone in this diagram were loose when it reached B or D it would travel towards C or E. But the string pulls the stone towards A, and this force modifies the other, so that the stone goes in a circle. The stone's tendency to fly straight is called centrifugal, or centre-fleeing force, and the force pulling it towards the centre is centripetal, or centre-seeking force.

HOW A PLANET'S MOTION TEACHES MEN THE LAWS OF THE UNIVERSE

This is enormously interesting looked at from that side, but it is still more important when we take the case of a thing which is actually moving—say, a planet—and moving in a certain direction at a certain speed. For, by the application of what we know about forces, we can discover what are the forces acting upon the planet, the net result of the whole of which, acting together, is that it moves as it does. The first law of motion says that a moving body tends to move in a straight line. Put a stone in a sling and swing it round your head. The stone does not move in a straight line, but in a sort of circle. But cut the sling, or let it go, and the stone flies out. Or take a planet swinging round the sun. The first law of motion says that its tendency is to move in a straight line, but in point of fact it moves in a closed path round the sun like the stone in the sling.

WHY THE PLANETS DO NOT FLY OFF INTO SPACE

In both cases the explanation is that there is all the time a pulling force acting and preventing the stone or the planet from flying off. Certain words are very commonly used to describe this tendency of the stone to fly out, and the tendency of the hand and the sling to hold it in a closed path. These words, which mean centre-fleeing and centre-seeking, are not useful. They date from a time when the laws of motion were not understood. The useful thing is to know what happens when a body, moving in a circular path under the action of two forces, first, the force of its own motion, and, second, the pulling force from the centre, is allowed to go its own way. The answer is that, when this occurs, it flies out at a tangent to the circle. On this page is a picture which shows a circle and two tangents to it, and if we suppose that the sling is opened when the stone is just at the point where the tangent BC or DE starts from, then the stone will fly out at that tangent.

It is nonsense to call the force which sends the stone flying out a centrifugal force. The stone is not trying to fly from the centre. If it is allowed to move on its own account, it will move in a straight line.

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DO THE STARS FALL DOWN?

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THE things that fall, and are called falling stars, are really not stars at all. If a real star fell into the earth—or, rather, if the earth fell into a star — we should all be burned up by the heat, long before the earth and the star could meet each other. The things that fall are really quite small stones, or pebbles, or balls of iron and other elements. They sometimes fall all the way to the earth, and can be picked up afterwards. By far the greatest number of them, however, never reach the surface of the earth as stones, or *meteorites*, at all, for they are burned up, or broken up, into dust by the earth's atmosphere; and a very great deal of the dust in the air, especially in the higher levels of the atmosphere, is made of this meteoric dust, as it is called by men of science.

We see only a few of the falling *stars* that are caught by the earth's atmosphere. For one thing, though they are falling all the time, we never see those that fall in the daytime. They are always made bright and hot as they pass through the air, but they are not nearly bright enough for our eyes to notice when the sun is shining upon our part of the earth. But, as these things are always reaching the earth, and as no matter can be destroyed and made into nothing, quite a lot of the present matter of the earth has been derived from meteors, or falling *stars*, in this way. The dust of them can sometimes be found lying on the snow of the highest mountains, where no other source of dust, such as smoke, is at work to produce it.

WHY DOES LIGHT TRAVEL QUICKER THAN SOUND?

We might reply by asking: Why should light and sound travel at the same rate? or: Why should not light travel slower than sound? If light and sound were waves of the same kind, traveling in the same thing, then it would certainly surprise us if they did not travel at the same rate, and we should want to know the reason why.

But light and sound are waves entirely different from one another, and they travel in quite different things. Sound travels in gases, such as the air, or in other material things, such as water, or even in solid things. Its speed varies according to the kind of matter it travels through, according to its temperature, and so on. But light travels in something called the ether, which is far more different from any ordinary matter, whether solid, liquid, or gaseous, than we can

imagine. The ether is intensely elastic, and so carries light through it faster than any waves can travel through ordinary matter. No difference in temperature seems to have any effect on the properties of the ether, and so light always travels through it, so far as we know, at exactly the same pace, no matter what the kind of light is—red, or green, or blue. So, also, every kind of ether-wave, light, radiant heat, or electricity, travels through the ether at exactly the same rate of speed.

HOW CAN WE SEE SUNLIGHT WHEN THERE IS NO AIR TO CARRY THE LIGHT-WAVES?

The reason is that the waves of light, though they are carried through the air, are not carried by it. Waves of light are waves in the ether, which is everywhere, whether there is air or not. Air carries waves of sound, which are usually waves of air, though they may be waves of other things besides air. But waves of light are always waves of ether, and nothing else. Air and other forms of matter, whether gaseous, like air, or liquid, like water, or solid, like glass, can have light-waves passing through them, because the ether is everywhere—even in glass or anything else—and it is the ether, whether air, or water, or glass be there, too, that carries the light. Ordinary matter, such as that of air or water or glass, only interferes with the passage of light—perhaps reflects it or absorbs it. The real question that might be asked is rather different, then, from this question. It should be: How can we see the light of the sun, if the air gets in the way of the waves of light in the ether?

WHAT MAKES AN ELECTRIC LAMP GLOW?

The electric light is quite different from the light of a fire, or a lamp, or a gas-jet, because it is not made by anything burning. So electric light does not use up the air of a room. When we turn it on, we simply allow the current, that has been made somewhere else, to run through the lamp. When the switch is off, the current does not run through the lamp, for there is a space, or break, between the metal wires that carry it. When we turn the switch on, we make the connection between the wire in the wall and the wire that runs to the lamp. If someone takes off the cover of the switch for us, we can see this. When the current runs through the lamp it meets with a certain amount of resistance from the wire, or thread, in the lamp. The thread is very thin, and the electric current, in forcing its way through, makes the thread so hot that it glows, and that gives the light. We know that we cannot get something out of nothing, and what happens here is, that part of the electricity is changed into the heat that makes the thread inside the lamp glow. The greater the flow of electricity, the hotter and brighter the thread gets, and the more electricity is used up. If there were air inside the lamp, the thread would burn away in a moment; but the lamps are so made that there is almost no air at all inside them. If we break the glass of the lamp, and admit the air, the thread will burn and snap in a moment when we turn the current on.

WHAT IS THE FORCE IN LIGHTNING THAT KILLS A MAN SO QUICKLY?

We use the word lightning to mean two distinct things—first, the light that is seen when electricity passes strongly from a cloud to the earth; and, secondly, the electricity which causes that light. The light itself is quite harmless. It may be seen at a great distance from the place where the lightning really passed, but whether it is seen from afar, or close at hand in a blinding flash, it cannot hurt anyone.

But the electricity itself is very different. If this strikes the ground close beside a man, it will do him no harm; but, if it actually passes to the earth through his body, it may kill him. It does this very suddenly, as a rule, by affecting the brain and the nerves that run from it to the heart. As we know, two of these nerves, one on each side of the body, are capable of stopping the heart altogether if they act powerfully. The electricity, in passing, stimulates, or excites, those nerves, so that they stop the heart, and the person dies from shock.

WHERE DOES LIGHTNING GO WHEN IT REACHES THE GROUND?

The lightning is the light caused by the passage of an electric current, or electric discharge, as we say. It is only a momentary consequence of the passage of the electricity; and, when the electricity has passed, the lightning-flash ceases, for there is nothing to make it flash any more. It is not the

lightning that reaches the ground, but the electricity; and that passes into the earth, and there causes changes which we are only beginning slowly to understand. It is changed when it enters the earth, and has an effect upon the soil, and, we are now sure, upon the life contained in the soil.

CAN A FIRE LIGHT ITSELF?

An ordinary fire cannot light itself, nor can any of the ordinary fuels that we use light themselves. If they did, they would be impossible to control. The reason why the fire laid in the grate, or the methylated spirit or oil in the lamp, does not light itself, though there is plenty of oxygen near it, is that neither coal, wood, paper, spirit, nor oil can burn—that is, combine with oxygen—except at a high temperature. When we light the fire, we produce that temperature, and then the fire itself maintains it. If a thing, in burning, does not produce enough heat to keep it burning, then it will always go out, unless we keep it warm. The ordinary heat of the sun is not sufficient to light wood or paper, but we know that, by using a burning-glass, we can char paper. It may be that, in some cases where a fire has started, and no one can say why, something has acted like a burning-glass to the sun's heat-rays, and so the sun has really lit the fire.

CAN PLANTS BE GROWN BY ELECTRICITY?

It has been thought for some time that the passage of electricity from the air to the earth, which is probably always going on to some extent, must have an effect on the life of plants. We know how valuable light is for plants, and electricity, we know, too, is very like light, though it happens that we cannot see it. Lately, fields of various plants, including the wheat-plant, which is so important for our lives, have been covered, at a little height, with electric wires, so arranged that electricity passes from them into the earth. The wires are placed on poles high enough for anyone to walk under them. And it has been proved that the increase in the amount of electricity that passes into the soil, or perhaps the amount that passes into the leaves of the plants, is *enormously* valuable. The plants grow more quickly and strongly; and they produce far more wheat, or potatoes, or whatever the crop may be. Plants, then, can be grown by electricity. Of course, they must have light and air, and food in the soil as well, and it now seems probable that all green plants grow largely by the aid of electricity, which is the reason why they grow so much better when we supply them with more. This discovery is one of the most important ever made about the growth of plants, for it promises that we shall be able to feed, say, twice as many people from a field of corn as we could before. People living on an island, which they cannot make any bigger, and where they cannot grow all the food they need, will see what a matter of importance this is.

WHY IS THE SUN BRIGHTER AT NOON THAN EARLIER OR LATER IN THE DAY?

The sun seems hotter and brighter when it is high in the sky, and seems hotter and brighter in the tropical regions, just because its light and heat pass more directly down through the air, instead of passing through it slantwise, and so having a longer journey through it. Everyone can understand that this must be so in the case of the ocean, and that the light-waves striking through it are lessened, so that the bottom of the ocean must be almost quite dark. Our minds and eyes can see how water must interfere with the passage of light, so that the sea must get dark very quickly as we go down; but the mind's eye cannot see so easily that the same must be true of the ocean of air, just because we are slow to realize that the air, though it is less dense than the ocean, is quite as material a substance, and therefore it must offer an obstacle to the passage of light.

The air allows a great deal of sunlight to pass through it—enough for us to live by—but no one yet knows *how* it is that any transparent thing, such as air, or glass, interferes so very little with the passage of ether-waves through it.

WHY, IF THE SUN REMAINS THE SAME, ARE SOME DAYS HOTTER THAN OTHERS?

There are several answers to this question. It may be that, though the sun itself has the same heat, its rays do not pierce through the air so directly on one day as on another, but much more slantwise. That is the great difference between a winter day and a summer day. The less distance of air the heat passes

through, the more we feel it. Then, again, if a warm wind is blowing past us, the day will be hotter than if a cold wind is blowing. That is to say, the heat of the day largely depends upon the wind, as well as upon the strength of the sun. Lastly, if the air contains a great deal of water-vapor, it can take up so much less from our bodies, and our perspiration does not evaporate, which means, form into water-vapor.

It is this evaporation of the perspiration from our skin that plays the chief part in keeping our bodies cool, though we are always making more heat as we live. If the evaporation of the sweat is made slow by the fact that the air already holds nearly all the water-vapor that it can hold, we get warm, and say that the day is hot. It may not really be any hotter than another day which feels far cooler; but we judge by our feelings, and they are largely determined by the freedom, or the difficulty, with which we dispose of the water that is continually poured out by our skin and from our lungs.

IF THE MOON HAS NO AIR, WHERE HAS ITS ATMOSPHERE GONE?

In this very interesting question we assume that the moon once had an atmosphere. But, plainly, we have no right to assume this. We must first try to find out whether it did have an atmosphere, and *then* we can try to discover where the atmosphere has gone. Astronomers believe that we are right in assuming that the moon once had an atmosphere, or coating of gas, as the earth possesses. There is even some evidence to suggest that, probably, there are a few remnants of the moon's atmosphere left in its deepest valleys; and this would help to account for the slow and small, but certain, changes that still go on upon the moon's surface, just as the earth's atmosphere helps to account for the many changes that occur on its surface.

An atmosphere is a gaseous envelope, and, in the study of the way in which worlds are made, we are sure that the production of such envelopes at an early stage must be the rule. And, to take an instance, we know that Mars has an atmosphere. But astronomers would even then hesitate to say that the moon once had an atmosphere, if they were at a loss to explain where it can have gone. Fortunately, we *can* explain this. When we study the movements of the atoms and molecules of gases, we learn that they must rush away from a planet, or a moon, unless it is so large that its gravitation can hold them to it. The earth's gravitation holds the air to it. Mars is smaller, and so cannot hold to it such a dense atmosphere as the earth: the moon is very small, and can hardly hold any atmosphere to it at all. All the tiny atoms of gas have flown off into space, but no one knows exactly where.

WHY DOES THE MOON NOT SHINE BY DAY?

The moon and the stars *do* shine by day, though we cannot often see them! And the sun shines by night, only we cannot see it. We are unable to see the sun shining at night, because we are on the opposite side of the earth to it. We cannot see the moon or stars shining by day, because the sun is so bright that the stars are *put out* altogether, unless the sun is eclipsed, when they are seen to shine; but it is not so bright as to prevent us from seeing the moon altogether. Of course, there are times in the month when the moon rises at sunset; but when the moon rises in the daytime it can often be seen; and, if it is seen, it is shining, though apparently it is not shining so brightly as it does in the darkness of night.

WHY DOES THE MOON GROW BRIGHTER AS THE SUN SETS?

If we watch the moon as the sun begins to set, we shall see it grow brighter and brighter, until, when the night has come, it is quite bright. Of course, it has really been shining just the same all the time, but the sun is sending so much light to our eyes, both directly and reflected from the air, that the light of the moon seems pale, and not worth calling even *moonshine*.

It is the same with all our opinions and feelings. One person in a room may shine so brightly by his talk that other people do not seem to shine at all; but when he goes we notice that they are shining, too. And, if we have a headache and suddenly knock our shin hard against something, we shall not feel the headache until the stronger pain in our shin has passed away. The sun *puts out* the moon just as it *puts out* the fire; it does not really do so, but it seems to our eyes to do so.

WHY CAN WE PUT OUT A CANDLE BY BLOWING?

The candle, like a fire, goes on burning after it is lit, because it produces heat enough to warm the stuff of which it is made up to the temperature at which it combines with oxygen. The wax of the candle is made into gases by the heat, and these hot gases are burned with the oxygen of the air. If we blow the candle, we blow away the hot gases with our breath, and, though our breath is warm, it is not nearly warm enough to keep the candle alight. What really happens then, is that, by blowing, we lower the temperature of the candle to a point below that at which the stuff of the candle and the oxygen of the air are capable of combining with each other. We thus put the candle in the same state as it was before it was lit, and it will not start burning again until new heat is supplied to it by another match.

DOES THE EARTH MAKE THE AIR THAT WE BREATHE?

The air that we breathe is part of the earth, and has been so from the earth's beginning. At one time, the whole of the earth must have been gaseous, and what we now call the air is simply the part of the earth that is still gaseous, and, being lighter than the solids or the liquid part of the earth, flies outside these, and forms a thick, unbroken envelope for them both. Any sun or planet that is large enough has an envelope of gas around it. We should not say it *made* this envelope, but that the envelope is the part of it that has remained gaseous.

It would really be just as reasonable to ask: Does the earth make the water that we drink? It is true, however, that the earth makes its own air, in the sense that the composition of the atmosphere is always being changed by the things that happen at the surface of the solid earth, or at the surface of the seas. Gases are passing into the atmosphere from living creatures and from the sea, and other gases are passing from living creatures and the sea to the atmosphere. Every shower of rain alters the composition of the air in some degree, and so does every breath we breathe.

WHY DOES THE AIR NOT STOP THE LIGHT OF THE SUN?

The air *does* stop a great deal of the light of the sun. We know that rays of heat and rays of light are really of the same kind, and the sun sends out both. The air stops a great deal of both. The sun and the moon and the stars are far brighter when we go up in a balloon, or if we look at them through a telescope on a high mountain, instead of one near the level of the sea. The reason is that their light has to pass through less air to reach our eyes. The air is a great blanket, and prevents the passage of light and heat to a great extent, whether from outside space to the earth, or from the earth to outside space. If there were no air, the light or heat of the sun, striking the earth, would be vastly greater than it now is. The moon has no air. If it had, even although there were no water in it to form clouds, the moon would be not nearly so brilliant as it is, for a great deal of the sun's light would be absorbed by the air.

WHAT IS IT LIKE ABOVE THE CLOUDS?

When we go up in a balloon above the clouds, or when we go so high up a mountain that we leave the clouds beneath us, we find exactly what we expect. The air is very bright and clear, and the sun—or the stars, if it is night—are seen very distinctly. Both sides of a cloud are very much the same, and when we look down on the clouds from above, they appear just the same as bright clouds appear from the earth. They are, of course, always bright clouds that we see from above, because we are looking at the side of them upon which the sun is shining. We find much the same thing if we go up in a balloon through a London fog.

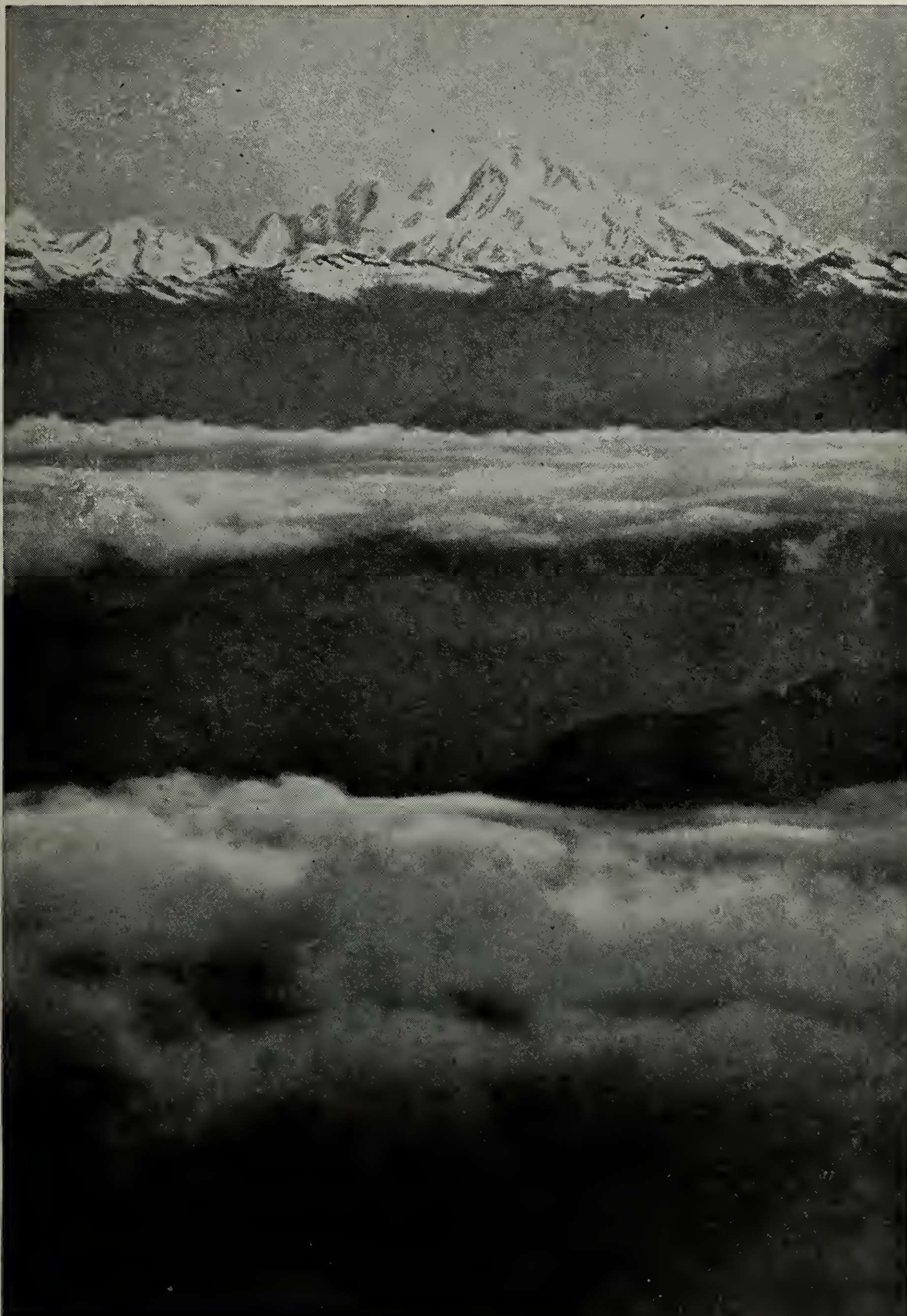
Some astronomers who did this found that, at a height of several thousand feet, the balloon soared clear of fog, and came out into brilliant sunshine. They saw the fog beneath them, but, of course, they saw it as a quite bright thing, as a great deal of the sunlight which should have been pouring down upon London was stopped by it, and reflected back from its surface to their eyes. When there is no fog, but only clouds scattered about, and we go up above them in a balloon, we get glimpses of the earth between them as we look down; and those who have seen this say that it is a very wonderful sight. Of course, they do not see the earth spinning underneath them, because the air spins round with

THE CHANGING BEAUTIES OF THE CLOUDS

We have all noticed the different forms which clouds assume. Sometimes they are high up, and look like down or delicate feathers, as in our middle picture, when they are called cirrus, which means "a hair." At other times the clouds are like masses of wool, as in the bottom picture, and are called cumulus, or "wool-pack" clouds. Heavy black rain-clouds are known as nimbus, while those that stretch in straight lines across the sky are stratus. We often see clouds that are partly one kind and partly another, and they have such names as cirro-cumulus, cumulo-nimbus. In the top picture we see cumulo-stratus clouds.

The photographs on these pages are by J. Valentine and others.

A MOUNTAIN-TOP ABOVE THE CLOUDS



We should hardly think that the snowy peak seen in this picture was the highest mountain in the world, for other pictures, like that on page 3922, show mountains that seem higher. But when a mountain is situated among other very high peaks, as this is, it never looks so high as if it stood alone. This picture of Mount Everest, in the Himalayas, was taken from a place near Darjeeling, which is over 7,000 feet high, and from that point we are looking down upon banks of clouds. Mount Everest is 29,002 feet, or exactly five and a half miles, high, and it was named after Sir George Everest, a great official surveyor in India.

the earth, and the balloon spins round with the air.

WHY DO SO MANY PIPES BURST DURING FROSTY WEATHER?

We know already that water has a great peculiarity in the way it behaves when it is cooled. The rule is, that a thing contracts and shrinks as it cools, and if water is cooled down to within a few degrees of its freezing-point, it obeys this rule. But if it is cooled still farther, it then begins to expand, until it freezes and turns into ice. So ice occupies more space than the liquid water which is nearly cold enough to turn into ice, but not quite. When the frost comes, it often freezes the water in the pipes in our houses, and, as this means that the water, in the form of ice, occupies more space than it did before it was frozen, it cracks the pipes.

The water, when it freezes, is stretched, so to speak, to form ice, and bursts the pipe that tries to prevent it from stretching or expanding itself. This gives us some idea of the power of its expansion. Of course, as long as the frost continues, we do not notice any bursting of our water-pipes, but, as soon as the thaw comes, the ice in the pipes melts, the water runs out, and causes damage. Many people therefore think that the thaw bursts the pipes, but, as we see, they are wrong. The frost bursts the pipes, and the thaw only shows us that they are burst.

WHAT IS THE BLUE LIGHT THAT WE OFTEN SEE ON THE SEA AT NIGHT?

This is sometimes called phosphorus, but it is not well to give it that name, for phosphorus is the name of a particular chemical element, and the light on the sea has really nothing to do with phosphorus.

But phosphorus itself shows this light, and so the light gets its proper name, which is *phosphorescence*. The light on the sea, and the light shown by phosphorus when it is exposed to the air, or to oxygen, are due to the same cause, the occurrence of slow burning, or combustion, or oxidation. There is no free, uncombined phosphorus in sea-water, and, though there are salts containing phosphorus, called phosphates, in it, they have nothing to do with its phosphorescence.

But the sea is really full of living matter, and of matter which has been alive—the bodies of dead sea-creatures, some animal and some vegetable. These are slowly oxidized by the oxygen which is dissolved in the sea-water, and has been got from the air, and as they are oxidized, or burned, they give out the faint light which we see.

WHY IS IT EASIER TO WALK ON A ROUGH SURFACE THAN ON A SMOOTH ONE?

We might add to this question, Why is it easier to walk in boots that have nails in them than in new boots with slippery soles, and why are we wise to score the soles of new boots with a knife to make them a little rough? The answer to all these questions is the same, and it is that the roughness, whether it be on the ground, or on the soles of our boots, means friction, and without friction we cannot walk. Friction, or, to use a more familiar word, *rubbing*, means that the boot cannot slide along the surface of the ground, but stays without difficulty wherever we put it, and so walking is easy.

If we try to walk on ice with skates, we shall soon learn how important friction is for easy walking. We learn, too, that we *can* walk even without much help from friction, but, in order to do so, we must balance ourselves very carefully, so that there is no tendency for the boots to slide in any direction. As long as the weight falls equally on the whole of the boot, or the skate, there is nothing to make it slide, but it will slide if the weight falls unequally, unless friction prevents it. If there is enough friction, as there is when we walk on a rough surface we can take big steps, and need not trouble to balance our bodies carefully, for the friction will prevent our boots from slipping or sliding along the ground.

WHY DO OUR HANDS REMAIN DRY WHEN DIPPED IN QUICKSILVER?

Mercury, or quicksilver, is a true liquid, just as much as water is, and it can flow just as water can, if the conditions are right. When we dip our hands in water and withdraw them, the water clings to the skin; so that it wets the hands. There is sufficient attraction between the water and the surface of the hands to make this possible; though, even in the case of water, it all depends upon circumstances. For instance, we may coat our hands thickly in oil, and then we find that the attraction between the water and the oil is so small that our hands are

not wetted, or scarcely wetted at all. Mercury behaves to the hand in its ordinary state as water does to the oil-covered hand. Also, mercury is a very heavy thing, and so tends to fall back when the hand is withdrawn, even though some of the mercury may try to cling to it. Even when the hand is perfectly clean, it is still much more oily than we think, and it is not possible to free the hand entirely from oil, for the skin of the hand actually produces oil to some extent. But if we use something that is *quite* free from oil, we can sometimes get mercury to flow over it and wet it, in just the same way as water would, though never so freely as water will.

HOW CAN A FEW IRON RODS BEAR THE WEIGHT OF A SUSPENSION BRIDGE?

Well, in the first place, it very much depends upon the iron. No one would trust very much to a suspension bridge made of any ordinary kind of iron. But if we *melt*—for that is what we really do—the right proportion of carbon in the iron, and get them to mix and hold together in the proper way, then we get a new kind of iron, which is vastly different and vastly stronger. It is this steel, as we call it, of which suspension bridges are made. No human being can say how or why it is that steel has the wonderful property upon which the building of suspension bridges depends. All we can say is, that steel has a wonderful power of resisting anything that tries to extend or stretch it. This power of resisting extension is called tensile strength. The tensile strength of good steel is amazing, and in the last few years steels still more wonderful have been made, thin wires of which will support enormous weights. But let no one suppose that mere iron can be trusted, as iron can when it has other things rightly added to it to make steel.

WHAT MAKES US RED WHEN WE ARE HOT?

When we say we are hot, we mean that we feel hot. A man may be really very hot and yet feel cold—as in the fever called malaria—because there is little warm blood in his skin, and it is the skin that holds the heat-nerves. When we *feel* hot, the skin is being supplied with a lot of blood. This need not be unduly hot blood; it may be blood of the right temperature, as when we blush, and *feel hot all over*. The quick supply of warm blood rushing through the skin affects the heat-nerves, and so we feel hot. Of course, when there is an unusual amount of blood in the skin, its color shows, and so we look redder than usual. So the question would be just as right if it were put in this form: What makes us feel hot when we are red? When we have been burned, or have had our chest rubbed with camphorated oil, or when we have a red skin from exposure to the sun, that part of the skin feels hot, and the heat-nerves feel the warmth of the unusual supply of blood around them.

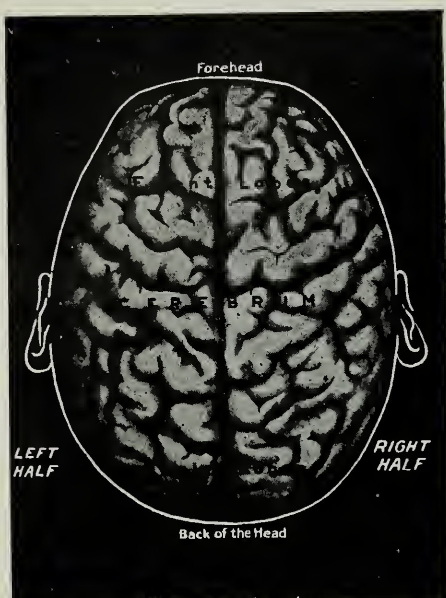
The question has another answer. The reason why we get red when we are really hot, as in fever, or when we have been running hard and making a lot of heat in our muscles, is that the excess of heat must be got rid of. So the blood is allowed to flow more quickly and freely through the surface of the body—causing us to become red—and there it is made cooler.

WHY HAS WATER NO TASTE?

It is perfectly true that pure water has no taste, but probably not one in ten thousand of those who read this question have ever tasted water that had no taste. None of us has ever tasted pure water, unless we have been to the chemist's and have tasted water that has been distilled. The ordinary water we drink has quantities of air dissolved in it, and these give it a taste. It also has a certain amount of salts dissolved in it. If we boil water, we drive off the gases in it, and then it does become tasteless and flat. That is the reason why one of the many ways in which to spoil a cup of tea is to let the water *go on* boiling before we make the tea. Why pure water should have no taste is very plain. Our bodies mainly consist of water. The nerves of taste, and their endings in the tongue, mostly consist of water themselves, and they live in water. Therefore we should not expect water to be one of the things that excites them. If it were, we should be tasting it all the time. There would be no use or meaning in this, and all our senses exist for use. Their business is to tell us of new things happening, not of things always there. So water, therefore, has no taste, and air no smell.

THE NEXT QUESTIONS ARE ON PAGE 3773.

THE INSIDE AND OUTSIDE OF OUR BRAINS

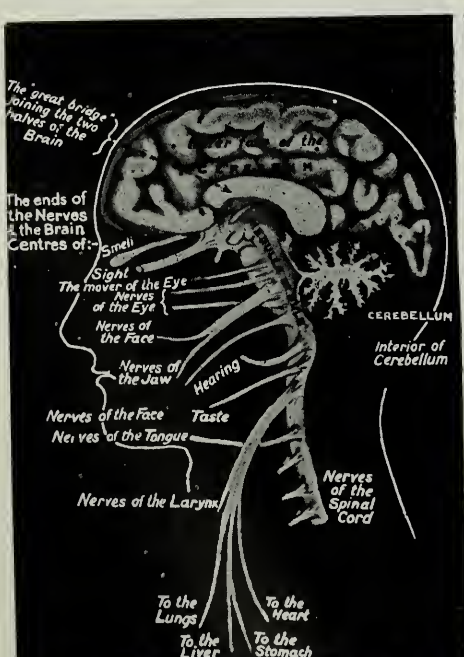


The Brain seen from above

In this picture we see what our brain would look like if the top of our skull could be lifted like a lid. The cerebrum, or new brain, is the part by which we reason, and it completely covers the cerebellum.

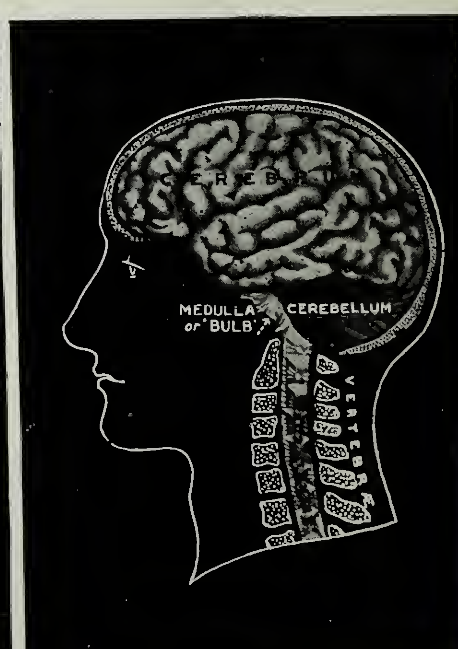
The Brain with Nerve endings from beneath

Here we are looking up at the underneath part of the brain, and see the nerve-endings of the senses and the vital organs, all cut off short, except the nerve of smell, which is shown ending in a bulb.



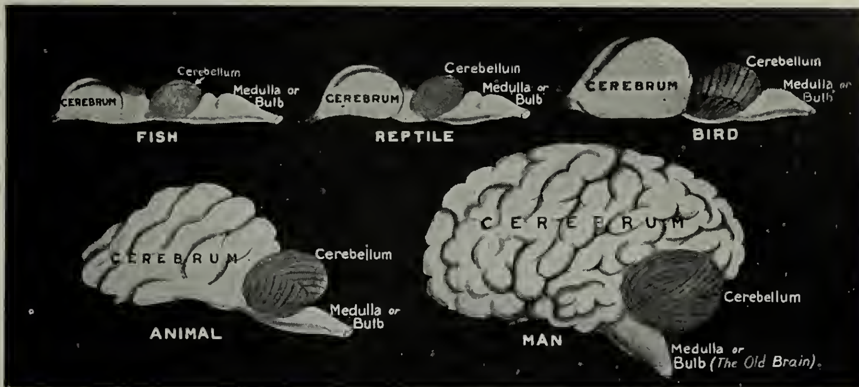
Picture-diagram of a section through the Brain

This section of the brain, as seen from the side, should be compared with the picture of the brain seen from underneath. In both pictures, the nerves are shown in the order in which they leave the bulb.



Side view of the Brain

In this side-view of the brain, we see the proportion of the skull occupied by the brain. The convolutions, or folds, are shown, and the position of the brain in relation to the spinal cord and the backbone.



These diagrams enable us to compare a man's brain with the brains of other creatures. The size of each is drawn in proportion to the size of the creature's body, and we see that man's brain is large.

THE MYSTERY OF THE BRAIN

CONTINUED FROM 3600

WE now know that, in ourselves, the highest and most important part of the nervous system is what may be called the new brain. The picture on page 3686 shows what it looks like when viewed from above, and the first thing we notice is that there is nothing else to be seen but the new brain. It is so large, and has grown out so far in all directions, that the whole of the older part of the nervous system is hidden underneath it. In an ordinary way, when we talk about a man's brain or brains, it is entirely of this new brain that we are thinking. The proper name for it is cerebrum. The word cerebellum, which we already know, really means little brain.

Now, our first glance at the cerebrum shows us that it is a double organ. It has a right half and a left half. These two are just like each other, though it is probable that in right-handed people the left half, and in left-handed people the right half, is very slightly larger. We have therefore, in a sense, two brains, just as we have two arms; for our bodies are built upon the principle of there being two halves corresponding to each other. If we slightly separate the two halves of the cerebrum, and look down between them, we can see a mass of white nervous tissue which is evidently running across from one side to the other. This is a great bridge between the two halves of the brain, by which they are made to work and act as one. When we look at the surface of the brain, we see at once that it is very much folded; all over it the surface has been turned inwards into deep valleys. These vary in depth and length, but on the whole they form a very definite pattern, which is the same on both sides of the brain, and the main lines of which are the same in all human beings. All the folds and the spaces between them have special names.

First let us understand what the folding means. The use of it is that it permits what is really the surface of the brain to be enormously increased, without requiring it to take up more room. Now the surface of the brain, as we shall see, is the all-important part. Brains have been growing larger in the animal world generally for countless ages past. This means that there has been a great deal more room required to house the brain in, and so skulls have been growing larger. The size of the skull of man,

compared with the size of his whole body, is simply gigantic. But though this is so, it very feebly indicates what the huge growth of man's brain has been, simply because the brain has grown far more quickly than the skull, as life has ascended, and has deeply tucked in its surface, here and there, as it went on growing, until there is now as much, or perhaps considerably more, of the surface of the brain tucked away than shows on the outside. In general, the higher the type of brain, the more is its surface folded. We can show this whether we trace the brain upward in different kinds of animals, or whether we compare different human brains with one another. As animals have become more and more clever, and have trusted more and more to brain and skill, rather than to size and strength, the surface of the brain has become more folded, and people who study the subject can tell in a moment, by looking at the surface of the brain alone, whether it belongs to one of the older kinds of animals or to one of the cleverer animals that have more lately appeared on the earth.

THE MANY FOLDS IN THE BRAINS OF VERY CLEVER MEN

A great many brains of famous men have been examined; many great men, indeed, have left orders that their brains should be examined for the advance of knowledge. As a general rule, these brains are found to be very highly folded. The contrast is very great between them and the brains of, say, such a humble type of mankind as the Bushman of South Africa. Of course, this means that if we could unfold all the brains in question, and stretch out their surfaces quite flat, the cleverer brains would be the brains with the biggest surfaces.

The size of the skull, its shape and the bumps on it, can tell us absolutely nothing whatever as to how much the brain is folded; still less as to what we shall find when we examine more closely what the foldings are made of. There is, on the whole, and in a very rough way, some correspondence between the size of the skull and the size of the brain inside it. But, for one thing, skulls vary in thickness; and, for another, no one can possibly tell what it is that is making up the size of the brain. Even if all skulls were the same thickness, and even if bumps corresponded to the brain, which they never do, the brain inside might be large because certain spaces inside it were swollen with fluid, or it might be large but have a comparatively smooth surface. It is quite easy to understand that a well-packed brain, which will go into a much smaller skull than another, may yet, if unfolded, turn out to have a far greater surface.

WHY THE SKULL CAN TELL US NOTHING ABOUT THE BRAIN

About a hundred years ago, when practically nothing was known about the brain, men thought that, by feeling and measuring the skull, they could learn about the brain, and so tell the character of the person to whom it belonged. Our modern knowledge of the brain has taught us that it is hopeless to expect this, simply because the things that really matter do not affect the skull at all. If a very large and dangerous surgical operation were performed, so that a considerable portion of the brain were exposed and could be seen, then we might, perhaps, make a very rough guess as to what the person was like; but as we should have to judge how far we were right entirely by what we knew of the person in the ordinary way, it is difficult to see where the advantage of such an operation would come in.

Now, we must understand why it is that the surface of the brain matters so much. Directly we cut through the cerebrum of any of the higher animals, we find at once that it consists of an outside layer, which is grey in color, and an inside layer, which is white. This grey layer, which covers the entire brain, always dips down and up again wherever the brain is folded. There would be no meaning in the folds if it did not. It is often called the *mantle*, that is, something which is stretched all over the outside of the cerebrum.

THE REAL BRAIN OF MAN THAT IS THE MOST WONDERFUL THING WE KNOW

At no part whatever of either half of the brain, whether we look at the part it rests upon or in the depths of any of the folds, do we find this wonderful mantle lacking. It is the real brain, and, as we find it in mankind, it is the most wonderful thing of which we have any knowledge. It owes its grey color, and all its meaning and wonder, to the fact that it is mainly made up,

not of nerve-fibres, but of nerve-cells. The rest of the brain is made up of nerve-fibres or nerves, and these give it a white appearance, like that of an ordinary nerve in the arm or the leg; but the grey mantle contains only comparatively few nerve-fibres, which connect its different parts in some degree.

HOW THE REAL BRAIN IS MADE UP OF THOUSANDS OF MILLIONS OF CELLS

What really makes up the grey mantle is thousands of millions of nerve-cells. These nerve-cells are vastly more wonderful even than those we find in the spinal cord, or those which live in the bulb and control our breathing, for they have to do with thinking, not to mention seeing and hearing, and so on.

Only a very few years ago, it used simply to be taught that when we take a very thin layer of this grey mantle, and look at it under the microscope, we see five layers of cells in it; one on the very surface of the brain, and so on, until the fifth lies next the white matter inside the brain. We can recognize these five layers because the cells in the different layers differ from one another in their size and shape and number. But now we can go much farther than that. It is, in general, true that we find about five layers of cells in any part of the grey mantle that we care to examine, but we also find that the cells differ very definitely in different parts of the brain. Also, if we carefully examine corresponding parts of the brain in large numbers of animals of quite different kinds, we find that the same arrangement of cells occurs in corresponding places.

THE LIKENESS BETWEEN THE BRAIN OF A MAN AND THE BRAIN OF AN ANIMAL

If we showed a man who had studied the subject a microscope slide containing a large number of cells shaped like pyramids and arranged in a certain way, he very likely could not be sure to what animal the brain had belonged, but he could say in a moment that that was the part of the brain which the animal used when it wished to move its muscles.

Again, if he saw certain curious little groups of cells lying not very far from the surface of the brain he would say, without hesitation, "that comes from the part of the brain with which the animal smelled." No one has the least idea yet what this particular group of nerve-cells has to do with smelling, but we always find them in the smell part of the brain, and nowhere else. This is equally true of creatures like the dog, in whom the smell part of the brain is large, and of creatures like ourselves in whom the smell part of the brain is comparatively quite tiny.

The parts of the brain which have to do with sight and with hearing are just as definite in their structure, so that it is much easier to tell that we are looking at something taken from the vision part of the brain than to tell the kind of animal from which it was taken.

The whole of the surface of the brain has been mapped out now very completely. On page 3686 we see a picture of the bottom of the human brain, showing the nerves to the different parts which we know have special duties.

WHY A MAN'S BRAIN IS BETTER THAN AN ANIMAL'S

Now, when we have carefully learned to map out the various brain centres, as they are called, for the motion of muscles, for feeling from the skin, for sight, hearing, taste, and smell, we find that still the *greater part* of the whole surface of the brain is actually untouched. It is almost as if the greater part of the surface of the brain had no duties. We cannot find that it has anything to do with any of the duties of which we can think.

Now, when we begin to examine the brains of other animals, it soon becomes possible to take, shall we say, twenty different brains, and arrange them in an ascending order, beginning with the brain of some simpler kind of animal, as, for instance, a rabbit, and ending with the brain of man. If we do this we find a very wonderful thing. It is that the lower we go down, the nearer together in the brain are the different special centres which we have already found in the brain of man.

Indeed, when we go low enough, the whole brain practically consists of these various centres—for motion, and seeing, and so on—all lying right up next to each other. They make the brain. But to look at it the other way, as brains improve and get bigger, what happens is, not that these various centres get

bigger, but that they become gradually separated from each other by the growth of new parts of the brain which appear and come to lie between the old centres. This process goes on and on, until at last in mankind, and only in mankind, it has reached the stage at which the various special centres, which long ago lay all together and *were* the brain, have become mere patches that lie here and there on the surface of man's huge brain.

What, then, is the meaning and the duty of these great new places that have come into existence, and to which the growth in the size of the brain is really due? When we question them, they are, so to speak, silent; indeed, they have been called the silent areas. We shall surely get some help in our studies if we can trace the course of the nerve-fibres that run out from the nerve-cells in these particular areas.

THE WONDERFUL FIBRES THAT LINK ALL OUR SENSES TOGETHER

As regards the special centres, we find that the fibres from the cells in them run just where we should expect. The fibres from the seeing centre run straight to the eye, the fibres from the hearing centre are connected with the ear, the fibres from the centre for movement run down into the spinal cord and are connected with the nerves that go to the muscles. These facts, of course, help to give us the key to the duties of these centres. If, now, we can find where the nerves run to from the silent areas, we shall guess what these areas really do, and it must be something very important indeed, because, whatever it is, it seems to explain the real difference between clever animals and stupid ones, high ones and low ones.

We find, then, that these fibres from the silent areas run in every possible direction, but in very definite groups and ways, to the other centres of the brain. What they do is to *associate* one part of the brain with another. I think we can understand that if there were no such things, then, though an animal might see very well, nothing that it saw would connect itself in that animal's mind with anything that it had heard, or felt, or smelled. Now, when we come to study the way in which we act, the way in which we put two and two together; when we notice how one thing makes us think of another thing, we begin to understand how it is that the *association fibres* make all the difference in the world between a high brain and a low one.

WHERE A MAN'S BRAIN DIFFERS FROM THE BRAIN OF A DOG

If we compare the spinal cord or the bulb of a dog with that of a man, there is nothing worth mentioning to choose between them. If we compare the new brain of a dog with that of a man, we find a difference, but it is one which mainly consists in association fibres and cells. If we compare the vision centre of a dog with that of a man, we find the two in the same part of the brain in each case, and with the same special type of cells.

The difference, however, is that the grey mantle in the case of man is much thicker; and when we come to inquire into what makes it thicker, we find that it contains a much greater number of fibres, which are running to it from other parts of the brain, and of new cells, which have nothing to do with seeing itself, but which send fibres out from the seeing centre to all the other parts of the brain. In general, then, we may say that the differences between a high brain and a low brain are, first, that in the various special centres the grey mantle is much thicker in the high brain, because it is crammed with new association cells; and, second, that in the high brain the special centres are forced apart by the growth in between them of new parts of the brain, which do not mean the invention of any new kinds of senses, but mean bringing all the parts of the brain into closer relation and connection with one another.

SOME OF OUR SENSES THAT ARE MORE NOBLE THAN OTHERS

There are one or two very interesting exceptions to this rule, and they have a meaning. It must have struck all of us, if we ever think of our senses, that some of them are more noble than others. We agree—do we not?—that it is a more dignified thing to enjoy a picture than to enjoy a chocolate. Someone may say: "Well, in either case, we are simply using one of our senses; why is not one as good as another?" But when we suppose that vision and hearing are more noble than taste and smell, we are quite right,

and the reason is that they are more human. They reach a higher development in us than in any other creature, while so far as concerns smell, about which a great deal has been learned, it is probable that our brains are far inferior to those of almost any other creature that has a brain at all.

THE SENSE OF SMELL, THAT IS WEAK IN MAN AND STRONG IN ANIMALS

If we study the smell part of the brain in different kinds of animals, we find that smell reached its perfection ages ago, when vision and hearing scarcely existed. But such a sense as vision is far finer than smell, because not only does it act at very great distances, but it gives us a thousand times more information than smell can possibly give.

Therefore, part of the history of progress in the world of life has been that sight has improved and has largely taken the place of smell. This is most marked in ourselves. The dog is a very high kind of animal, and belongs to an order which ranks next to the monkeys themselves, and we all know how splendid the dog's scent may be. But in our own brains the part which corresponds to smell has shrunk to almost nothing; it is, indeed, so small that it took a very long time to find where it was; while the vision part of the brain has become huge.

The great growth of the back of the cerebrum in man is due to the importance of vision to him, for it is with the extreme back part of the cerebrum, on both sides, that we see. Our real eyes are at the back of our heads. We have already learned that the cerebellum is very large in us; but even though this is so, the vision part of the cerebrum has grown so enormously that the cerebellum is completely hidden from our sight by the cerebrum, when we look down upon the brain from above.

THE DIFFERENCE BETWEEN ONE KIND OF SENSE AND ANOTHER

It might be supposed that there is something wrong here, because many animals, such as birds of prey, have far keener sight than man has. That, indeed, is so; but are we right in supposing that the mere keenness of a sense is the highest thing about it? Not at all. The point is the extent to which we can use the information that the sense gives us, and the way it is linked up with every other part of our minds. The vulture can see a speck on the desert sand at a tremendous distance, but will the vulture enjoy a noble picture, or feel itself made humble and pure before a sunset? Of course, when we ask questions like this, we see at once what it is that really makes a sense high. No known animal has in the vision centre of its brain anything like the depth and variety of structure that we have in ours. This is the great fact for us to remember about the place where the seeing is really done.

We have seen that smell and taste are comparatively unimportant in man, and in both cases there was long argument, and much work had to be done, before we could be sure in what part of the brain these two senses really lived, so to speak. It might be supposed that the sense of touch would not be greatly developed in man, and that perhaps it is rather falling into the background, like smell and taste. This is a very great error, however. The most intelligent of all birds is the parrot. We notice this not only in its power of imitating sounds, but in many other ways.

WHY THE SENSE OF TOUCH IS CALLED THE MOTHER OF ALL THE SENSES

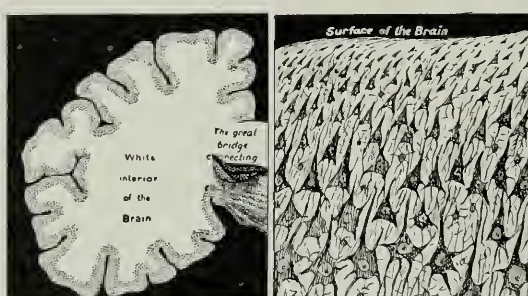
Now, it is an interesting fact that the parrot has a far more delicate sense of touch than any other bird. It really has quite a good notion of using its claws as fingers. It has the idea of stroking and feeling what a thing is like, as we say. Now, it is not just a chance that the most intelligent bird is the bird with the best sense of touch. It is what we should expect. The sense of touch is the mother of all the senses, in a way, and good education of the sense of touch is the foundation of all good education.

Probably some of those who read this will disbelieve it, but all the great students of the mind know that it is perfectly true, and have been saying so for scores of years. We are slowly learning to understand what games mean for children, because they train the sense of touch, and teach it how to work with sight; and, also, we are beginning to learn that drawing and carpentry, and the sort of things that children do in kindergarten, are invaluable foundations of education. There was a time

when it was thought that anything good for a child must be something that it disliked, and that anything it liked must be mere amusement. Who would think that the real meaning of the word school is *leisure*—doing what we feel inclined to do? Yet so it is.

Now, there is nothing we notice more positively about an intelligent child, and most children are intelligent until foolish grown-up people begin to interfere with their minds, than that it loves using its fingers. Of course it gets into mischief, but the child that never got into mischief, and never touched things it ought not to have touched, was never yet taught to read. There are such children, but they can be taught nothing, and we call them *imbecile*.

Whatever happens, the healthy child must constantly use its sense of touch; it must for ever be fingering things. Now, we find that the touch part of man's brain is simply magnificent. It is the delicacy and the variety of his sense of touch, and, far more than that, it is the marvelous way in which man's sense of touch is connected with all his other senses, that accounts for our skill, which is almost the most wonderful thing about us as compared with any other creature. Not in a thousand years could any other creature but man be taught, for instance, to read with the fingers, even if that creature had a brain that could understand.



The left-hand picture shows a section across one side of the brain, and we see by the shaded border the thickness of the grey matter, as compared with the white nerve-fibres. On the right is a tiny speck of the grey matter, magnified a hundred times, showing the pyramid-like cells and the fibres.

THE GREAT BRAIN PUZZLE THAT BAFFLED MEN FOR YEARS

For a long time it was a great puzzle to find the touch centre in man's brain. It lay, so to speak, under our very eyes; but we never thought of looking for it there. A very large area of the grey matter on each side of the brain is the centre for voluntary movement, and it is here that the will of man gives its orders. For many years we knew this, and called it the motor centre; and when we were looking for the centre of the touch sense we never thought of looking there. But now we have found that the centre for will and movement is the centre for touch. The two lie mixed up together, and the connection between them is the closest of all connections in the nervous system.

THE WONDERFUL NERVES OF HEARING, THAT ENABLE US TO ENJOY MUSIC

The sense of hearing lives low down on the side of the brain, as we see in the pictures on page 3686. As we all know, this sense of hearing has led to the possibility of music and all that that means. As in the case of seeing, of course there must be good machinery outside the brain if a sense is to develop, and the history of hearing, like the history of vision, is partly the history of the ear and the history of the eye. Here, however, we must merely learn that the hearing centre of the brain is very large in mankind, and that when we examine the cells contained in it we find a state of things that exactly compares with what we found in the case of vision. It may be that some animals can hear sounds so slight that we cannot hear them. That, as we have learned in the case of the eye and seeing, is not the test. No animal knows the difference between good music and bad; much less could any animal create a piece of music, even bad music.

Thus, this part of the grey mantle of the human brain is thicker than in any other creature, and, as we should expect, is very rich in association cells and fibres, that connect it with all the other parts of the brain. It seems, also, that there is a special part of the hearing centre, lying rather towards the front, which is concerned with music as distinguished from ordinary sounds; and though we do not know very much about this yet, it may be the case that this music centre is only found on the left side of the brain in right-handed persons, and on the right side of the brain in left-handed persons.

THE NEXT PART OF THIS IS ON PAGE 3817.

THE HEROINE OF NOTTINGHAM CASTLE

CONTINUED FROM 3594

ONE of the brightest stories from the Civil War in England is the defence of Nottingham Castle by Colonel and Mrs. Lucy Hutchinson. The building in the picture stands on the site of this famous old Norman castle. The king set up his standard on August 22, 1642, at Nottingham, near which the Hutchinsons lived. The whole country was greatly excited, and Ireton, their neighbor and relative, urged them to support the parliamentarians, which they did. Mr. Hutchinson received a commission as lieutenant-colonel, and the family removed to Nottingham for greater security. Soon, as Governor of Nottingham Castle, Colonel Hutchinson had to defend it.

For four years Mrs. Hutchinson was shut up in the castle, acting as surgeon during the siege, tending the sick, and supplying food for the big household, medicine also, where it was needed. She was ever brave and cheerful.

She shared all her husband's plans approved his stern refusal of the many attempts to bribe him into submission, and showed in the notes she wrote down at the time that she must have witnessed scenes and undergone anxiety enough to quell the stoutest heart. There were her little children, too, who needed her constant care. Newark, a neighboring town, was on the royalist side, and many of the citizens of Nottingham were also royalists. One of them during the night secretly let the Governor of Newark and six hundred soldiers into the town. Next morning the colonel found himself besieged in his little fortress with eighty men. Enemies were all around, but messengers got through and sent for aid to the garrisons at Derby and Leicester.

On the third day Colonel Hutchinson was invited to parley with the royalists in St. Nicholas' Church. His answer was to hoist a red flag on the tower of the castle and to fire his cannon at the church steeple. Two more days passed, and then, to their relief, the watchers on the tower saw a party of horsemen galloping to their assistance. As these men drew near, the royalists retreated, but not without a sally from the besieged, so that they retired in confusion.

When the war was over, Mrs. Hutchinson acted as peacemaker between a band of soldiers preparing to attack the town and the citizens arming for its defence, and later, when the Stuarts came back to power after Cromwell's death, she worked to secure her husband's pardon. It was denied, and the brave wife cheered and comforted her husband in prison in the Tower, and afterwards in Sandown Castle, until his death.

THE BOY WHO SAVED A CREW

IN the year 1798, during a heavy storm, a French ship, La Tribune, was wrecked one evening off Halifax, Nova Scotia, but a number of men belonging to the crew managed to climb into the rigging, where they remained all night, the people on shore being powerless to assist them in the raging tempest.

When daylight dawned, the poor men were still in the rigging, almost exhausted by their terrible experiences of the night. The sea was still rising in angry waves, and beating like a torrent upon the wreckage and the shore, and none of the strong men on the beach dared to venture out to rescue the shipwrecked mariners.

It was then that a deed of great courage and splendid heroism was performed by a boy, only thirteen years of age, whose name, unfortunately, has not been preserved to us. This lad had been watching the wreck for hours, and listening to the talk of the spectators, expecting that some of the latter would at any rate make an effort to save the wrecked sailors. When at last he found that no one dared to make the attempt, he determined to see what he himself could do to reach the stranded vessel.

Jumping into a small boat, the boy rowed with all his might toward the wreck, and although the wind and the waves were almost too strong for him, he managed at last to reach the ship, and get his little boat near enough to take off two of the men. They were too exhausted to assist in rowing to the shore, but the plucky boy, by great exertions, landed them safely.

Then he started for the wreck once more, but his strength was exhausted and he was unable to battle with the wind and waves, and had to return to the shore, to his intense grief and disappointment.

The brave example set by so young a lad bore good fruit, for the men were inspired into making an effort themselves, and several boats went out to the wreck, and were successful in saving all the men who had taken refuge in the rigging. But the credit for the rescue belongs to the unknown boy, who may truly be said to have saved the crew from death.

A BRAVE ROMAN YOUTH

SOON after the brave Horatius held the bridge against the Etruscans, Porsena, their king, defeated in his attempt to capture Rome, encamped with his army on the banks of the Tiber to watch his opportunity.

Now, there was a noble Roman youth named Caius Mucius, who was greatly distressed at the state of hunger to which his fellow-citizens were reduced, and so he plotted, with other young men, to free his country from the foreign invaders. Taking a dagger with him, he went to seek out King Porsena, with the intention of killing him.

But when he arrived at the place where the Etruscan king was wont to sit in judgment, he found the soldiers receiving their pay from a man whom he imagined to be the king, but who was really the king's secretary. Without hesitation, Caius Mucius unsheathed his dagger and stabbed him to the heart. Immediately the youth was surrounded by the guards and dragged into the presence of King Porsena, who angrily ordered him to be burned if he did not instantly confess the whole plot. But Caius Mucius stood dauntlessly erect, and refused to betray his friends.

"See," said he, "how little your tortures can avail to make a brave man tell the secrets committed to him." And, thrusting his right hand into a fire which burned near by, he held it there without shrinking.

King Porsena, astonished at such fortitude, and admiring his patriotism, told the guards to spare the youth and see him safely out of the camp.

"You are a brave man," said the Etruscan king, "but you have hurt yourself more than me."

Caius Mucius, moved to gratitude at such clemency, then told the king that his generosity had conquered where his threats had failed, and that three hundred youths had taken an oath to kill him, and he, Caius Mucius, had been chosen to make the first attempt.

So the Roman youth was released, but ever after he bore the name of Scævola, which means "left-handed," because his right hand was useless.

THE BOY ON THE BURNING DECK

FROM Corsica came a youth, the boy who "stood on the burning deck," whose fame is known to all through Mrs. Hemans' poem, given elsewhere in this book. The Corsicans say that he was Giacomo Jocante Casabianca, a middy who went in the Orient, the flagship commanded by his father, with the French fleet that Napoleon took to invade Egypt.

On the evening of August 1, 1798, Nelson sailed up to attack the French vessels as they lay in Aboukir Bay. Part of his fleet got between them and the shore, and he was able to fire on them on both sides at once.

The English guns were pointed for hours at the Orient, the finest ship of the fleet. Broadside after broadside was fired at her, yet still the French flag waved, until from Nelson's Vanguard a deadly fire wounded the captain, and set fire to the vessel. Inch by inch the flames drove back the sailors, and, one by one, they reluctantly abandoned their guns. Then Casabianca's father, mortally wounded, yet still at his post on the quarter-deck, gave his last order to the faithful defenders of his vessel to abandon her.

Begging him to come with them, they sprang into the water, where many were saved by the English. It was now between nine and ten in the evening, and the flames crept on, while the boy urged his father to jump into the sea with him. The father refused to desert his ship, but prayed his boy to leave him. The son leave his father! No. That was impossible for a Casabianca. He would die with him.

And so the two stood calmly, hand in hand, while the flames shot up from the portholes, and the deck caught fire beneath them. At last the end came; and, with a thunderous explosion, the burning vessel sank for ever beneath the blue waters of the Mediterranean.

THE DEVOTION OF A KING'S DAUGHTER

KING LOUIS XII. of France had a daughter, Renée, who became Duchess of Ferrara, in Italy, and a Protestant. She was always eager to help those in trouble. It is said that she aided more than ten thousand destitute French soldiers passing through Ferrara from the wars in Italy, and her castle of Montargis became the refuge of the persecuted Huguenots.

One of these, the Prince of Condé, had been imprisoned by the Duke of Guise; but he had a devoted and clever wife who, while visiting him in prison, managed to change clothes with him, so that she remained in his place while he escaped to Montargis.

This change was soon found out, but the Duke of Guise was foiled in all his attempts to trace the escaped prisoner. Then it occurred to him that, if the princess were released, she would follow her husband, so he gave orders to set her free. His guess proved correct; she was followed to Montargis.

The Duke of Guise, who had great power in the land, ordered the duchess to give up the prince, but she refused to do so. Even when the king, Francis II., demanded the same thing, and sent troops, she still refused. The prince in his little room overheard the brave refusal to surrender him, but he overheard, too, the timorous fears expressed by a few of the guards, and, turning to these, he cried that since they had not courage to defend him, his death should remove their fears. He hastened on to the ramparts with the intention of exposing himself.

Below him at the foot of the castle walls, he saw the officer of the artillery, and shouted to him that he was the man they sought, and that on him alone should vengeance be taken, so that he might die, as he had lived, with honor. Much astonished, the officer sent for his leader, who told him that he must certainly fire on the prince.

But the faithful duchess stood by the prince's side, and, seeing the cannon directed against her friend, threw herself in front of him, exclaiming:

"Fire on me, and kill at the same instant the illustrious Condé and the daughter of the king you mourn!"

The soldiers, who adored the memory of Louis XII., implored with one voice that his daughter should be spared, and, refusing to attack the castle, marched off to their tents. The prince and his friends escaped into safety that night.

THE NEXT GOLDEN DEEDS ARE ON PAGE 3739.

THE HEAVEN THAT LIES ABOUT A CHILD

In this picture, by Herbert Draper, we catch something of Wordsworth's idea when he wrote: "Trailing clouds of glory do we come from God, who is our home; heaven lies about us in our infancy." Gazing at the sunlight as it pours through the stained-glass windows, the child seems to see visions of paradise.

WORDSWORTH'S GREATEST POEM

WE have read many of Wordsworth's poems in this book, and we are now to read the greatest of all the many poems he wrote, though by no means the longest. Many people may think that it is too difficult for children to understand; but children can understand far more than is often supposed, and there is no real reason why they should not read this famous ode, with some explanations. Its full title is "Intimations of Immortality from Recollections of Childhood." That is to say, the poet in manhood seeks to base his belief in the future life on recollections of the thoughts that came to him as a boy. Surely that fact alone makes his great poem a suitable one for printing in this book.

ODE ON IMMORTALITY

A POET'S MEMORIES OF HIS CHILDHOOD

CONTINUED FROM 3606

The poet begins by stating that the dreams and visions of his youth had made the earth, and all his eyes had looked upon in early years, so beautiful to him, that in later life, when the commoner sights had become so familiar to him, they seemed to have lost some of the qualities they once possessed.

THERE was a time when meadow, grove, and stream,
The earth, and every common sight,
To me did seem
Apparelled in celestial light,
The glory and the freshness of a dream.
It is not now as it hath been of yore:
Turn wheresoe'er I may,
By night and day,
The things which I have seen I now can see no more.

II.

His knowledge tells him that earth and its wonders are not less fair than when he was young; but they have lost the "glory" which they had when his young eyes and opening mind first beheld them. As we grow older, we all experience the same change, just as "familiarity breeds contempt."

The Rainbow comes and goes,
And lovely is the Rose;
The Moon doth with delight
Look round her when the heavens are bare;
Waters on a starry night
Are beautiful and fair;
The sunshine is a glorious birth;
But yet I know, where'er I go,
That there hath past away a glory from the earth.

III.

But there are times in our later years when the singing of the birds and the frisking of the lambs suddenly bring up, as in a flash, our childhood's happy visions, and though we may be old in years we are as children again in memory.

Now, while the Birds thus sing a joyous song,
And while the young Lambs bound
As to the tabor's sound,
To me alone there came a thought of grief:
A timely utterance gave that thought relief,
And I again am strong:
The Cataracts blow their trumpets from the steep;
No more shall grief of mine the season wrong;
I hear the echoes through the mountains throng,
The Winds come to me from the fields of sleep,
And all the earth is gay;
Land and sea
Give themselves up to jollity
And with the heart of May
Doth every beast keep holiday;—
Thou child of joy,
Shout round me, let me hear thy shouts, thou happy Shepherd-boy!

IV.

Yet, in the midst of his delight in thus living over again his childhood's joys, the poet finds himself making note of some things—a tree and a field—that seem to be different now as compared with his early visions of them; thus the spell is broken, he is a man again, and trained thought takes the place of simple natural feeling and delight.

Ye blessed creatures, I have heard the call
Ye to each other make; I see
The heavens laugh with you in your jubilee;
My heart is at your festival,
My head hath its coronal,
The fulness of your bliss, I feel—I feel it all.
O evil day! if I were sullen
While the earth herself is adorning
This sweet May-morning,
And the children are pulling
On every side,
In a thousand valleys far and wide,
Fresh flowers; while the sun shines warm,
And the babe leaps up on his mother's arm:—
I hear, I hear, with joy I hear!
—But there's a tree, of many one,
A single field which I have looked upon,
Both of them speak of something that is gone;
The Pansy at my feet
Doth the same tale repeat:
Whither is fled the visionary gleam?
Where is it now, the glory and the dream?

V.

Then he begins to think what these remembered visions of his vanished childhood may mean. In this great stanza he sets forth his thoughts. We may have lived before, and as in manhood we catch fleeting visions of our childhood, so may we have faint visions of a previous existence.

Our birth is but a sleep and a forgetting:
The Soul that rises with us, our Life's Star,
Hath had elsewhere its setting,
And cometh from afar:
Not in entire forgetfulness,
And not in utter nakedness,
But trailing clouds of glory do we come
From God, who is our home:
Heaven lies about us in our infancy!
Shades of the prison-house begin to close
Upon the growing Boy,
But He beholds the light, and whence it flows
He sees it in his joy;

The Youth, who daily farther from the East
Must travel, still is Nature's Priest,
And by the vision splendid
Is on his way attended;
At length the man perceives it die away,
And fade into the light of common day.

VI.

It may be, the poet suggests, that our present existence here on earth, with all its distractions and pleasures, has dulled in us the memory of the "imperial palace" or heaven, whence our souls have come, just as the experiences of manhood and age certainly dull in us the memories of our childhood.

Earth fills her lap with pleasures of her own;
Yearnings she hath in her own natural kind,
And even with something of a mother's mind,
And no unworthy aim,
The homely Nurse doth all she can,
To make her foster-child, her inmate Man,
Forget the glories he hath known,
And that imperial palace whence he came.

VII.

The thought expressed in the previous stanza is followed further in the next. But we are to remember that the poet never asserts as a fact that he believes in a past existence. The idea is a very old one and is a feature of some religions, such as Buddhism, and the poet suggests it for a poetic purpose which will presently appear.

Behold the Child among his new-born blisses,
A six years' darling of a pigmy size!
See, where mid work of his own hand he lies,
Fretted by sallies of his Mother's kisses,
With light upon him from his Father's eyes!
See, at his feet, some little plan or chart,
Some fragment from his dream of human life,
Shaped by himself with newly-learned art;
A wedding or a festival,
A mourning or a funeral,
And this hath now his heart,
And unto this he frames his song:
Then he will fit his tongue
To dialogues of business, love or strife;
But it will not be long
Ere this be thrown aside,
And with new joy and pride
The little Actor cons another part;
Filling from time to time his "humorous stage"
With all the persons, down to palsied age,
That life brings with her in her equipage;
As if his whole vocation
Were endless imitation.

VIII.

The poet now addresses the child. The little boy, the little girl, is the greatest wonder of the world! For in his little body is the seed of everlasting life; he is "glorious in the sight of heaven-born freedom;" but, as the years grow upon him and make the wonders of the world commonplaces to him, he will become less and less conscious of the wonders he moves among; "custom" will "lie upon" him; he will do his daily work with far too little thought of his immortal powers.

Thou, whose exterior semblance doth belie
Thy soul's immensity;
Thou best Philosopher, who yet dost keep
Thy heritage; thou Eye among the blind,
That, deaf and silent, read'st the eternal deep,
Haunted for ever by the eternal mind,—
Mighty Prophet! Seer blest!
On whom those truths do rest,
Which we are toiling all our lives to find
In darkness lost, the darkness of the grave;
Thou, over whom thy immortality
Broods like the day, a master o'er a slave,
A presence which is not to be put by;
Thou little Child, yet glorious in the might
Of heaven-born freedom on thy being's height,
Why with such earnest pains dost thou provoke
The years to bring the inevitable yoke,
Thus blindly with thy blessedness at strife?
Full soon thy soul shall have her earthly freight,
And custom lie upon thee with a weight,
Heavy as frost, and deep almost as life!

IX.

Yet, just as at times these visions of our childhood rise again in our mind, so must we in our later years, when our knowledge is ripened, realize that these visions have a mighty power in opening for us the very gateways of immortality. They are not so much to be regarded as glimpses of a life that is past, as of an immortal life of the soul which endures for ever. The very fact that such thoughts ever arise in us is a proof that there exists for us some other life beyond the life we are living in this world to-day. They are like the echoes, far away and faint, of a great sea; that sea is the immortal life of the soul, and death is but the beginning of our heavenly voyage, our launching on the immortal sea.

O joy! that in our embers
Is something that doth live,
That nature yet remembers
What was so fugitive!
The thought of our past years in me doth breed
Perpetual benediction: not indeed
For that which is most worthy to be blest;
Delight and liberty, the simple creed
Of childhood, whether busy or at rest,
With new-fledged hope still fluttering in his breast:—
Not for these I raise
The song of thanks and praise;
But those obstinate questionings
Of sense and outward things,
Fallings from us, vanishings;
Blank misgivings of a Creature
Moving about in worlds not realised,
High instincts before which our mortal Nature
Did tremble like a guilty thing surprised:
But for those first affections,
Those shadowy recollections,
Which, be they what they may,
Are yet the fountain light of all our day,
Are yet a master light of all our seeing;
Uphold us, cherish, and have power to make
Our noisy years seem moments in the being
Of the eternal Silence: truths that wake,
To perish never;
Which neither listlessness, nor mad endeavour,
Nor Man nor Boy,
Nor all that is at enmity with joy,
Can utterly abolish or destroy!
Hence, in a season of calm weather,
Though inland far we be,
Our souls have sight of that immortal sea
Which brought us hither,
Can in a moment travel thither,
And see the children sport upon the shore,
And hear the mighty waters rolling evermore.

X.

Thus, at last in our old age, even when worldly knowledge may have dulled our childhood's memories, the joyous feelings of our early years may yet awaken within us, and our ripened senses should tell us that these feelings are the very truth of God speaking to us, not in words, but in a way no words can speak, of the immortal life to which we are born, if we only have "the faith that looks through death."

Then sing, ye Birds, sing, sing a joyous song!
And let the young Lambs bound
As to the tabor's sound!
We in thought will join your throng,
Ye that pipe and ye that play,
Ye that through your hearts to-day
Feel the gladness of the May!

What though the radiance which was once so bright
Be now for ever taken from my sight,
Though nothing can bring back the hour
Of splendour in the grass, of glory in the flower;
We will grieve not, rather find
Strength in what remains behind:
In the primal sympathy
Which having been must ever be;
In the soothing thoughts, that spring
Out of human suffering,
In the faith that looks through death,
In years that bring the philosophic mind.

XI.

So that, in the end. when we are old, if we have preserved our faith, though we may have lost the keen sense of wonder and delight we enjoyed in childhood, we shall still, in a different way, rejoice in all God's beautiful creation. The glory of the setting sun is the glory of our lives if we have lived righteously in the eye of God. When the sun of our life sets, it will rise again in the other world that endures for ever and is known to us as heaven. Thus do we see how, from the recollections of his own childhood, the poet is led to believe in the undying life of the soul

And O, ye Fountains, Meadows, Hills, and Groves,
Think not of any severing of our loves!
Yet in my heart of hearts I feel your might;
I only have relinquished one delight
To live beneath your more habitual sway.
I love the Brooks which down their channels fret,
Even more than when I tripped lightly as they;
The innocent brightness of a new-born Day
Is lovely yet;
The Clouds that gather round the setting sun
Do take a sober colouring from an eye
That hath kept watch o'er man's mortality;
Another race hath been, and other palms are won.
Thanks to the human heart by which we live,
Thanks to its tenderness, its joys, and fears,
To me the meanest flower that blows can give
Thoughts that do often lie too deep for tears.

THE DESERTED HOUSE

Tennyson here reads us a little lesson in life and immortality. The deserted house may be likened to the earthly body of man when death has taken possession of it and the soul has gone away to live "in a mansion incorruptible."

LIFE and Thought have gone away
Side by side,
Leaving door and windows wide—
Careless tenants they!

All within is dark as night;
In the windows is no light;
And no murmur at the door,
So frequent on its hinge before.

Close the door, the shutters close,
Or thro' the windows we shall see
The nakedness and vacancy
Of the dark, deserted house.

Come away. No more of mirth
Is here, or merry-making sound.
The house was builded of the earth,
And shall fall again to ground.

Come away—for Life and Thought
Here no longer dwell;
But in a city glorious—
A great and distant city—have bought
A mansion incorruptible.
Would they could have staid with us!

MY COUNTRY 'TIS OF THEE

This song, by Samuel Francis Smith, has long been regarded as the national hymn of the American people, breathing, as it does, the spirit of liberty which the government of our country offers to its citizens.

MY country, 'tis of thee,
Sweet land of liberty,
Of thee I sing;
Land where my fathers died,
Land of the pilgrim's pride,
From every mountain side
Let freedom ring.

My native country, thee—
Land of the noble free—
Thy name—I love;
I love thy rocks and rills,
Thy woods and templed hills;
My heart with rapture thrills
Like that above.

Let music swell the breeze,
And ring from all the trees
Sweet freedom's song:
Let mortal tongues awake;
Let all that breathe partake;
Let rocks their silence break—
The sound prolong.

Our fathers' God, to Thee,
Author of Liberty,
To Thee we sing:
Long may our land be bright
With freedom's holy light,
Protect us by Thy might,
Great God, our King.

AT LAST

John Greenleaf Whittier, the Quaker writer, lived to 85, and towards the end of his life could sing with undimmed faith of his simple all-sufficing trust in God, as in this poem.

WHEN on my day of life the night is falling,
And in the winds from unsunned spaces blown,
I hear far voices out of darkness calling
My feet to paths unknown.

Thou who hast made my home of life so pleasant,
Leave not its tenant when its walls decay;
O Love divine, O Helper ever present,
Be Thou my strength and stay!

Be near me when all else is from me drifting:
Earth, sky, home's pictures, days of shade and shine.
And kindly faces to my own uplifting
The love which answers mine.

I have but Thee, O Father! Let Thy Spirit
Be with me then to comfort and uphold;
No gate of pearl, no branch of palm I merit,
Nor street of shining gold.

Suffice it if—my good and ill unreckoned,
And both forgiven through Thy abounding grace—
I find myself by hands familiar beckoned
Unto my fitting place.

Some humble door among Thy many mansions,
Some sheltering shade where sin and striving cease,
And flows for ever through heaven's green expansions
The river of Thy peace.

There, from the music round about me stealing,
I fain would learn the new and holy song,
And find, at last, beneath Thy trees of healing,
The life for which I long.

QUEEN MAB AND HER FAIRIES

No one knows who wrote this merry song describing the midnight revels of the fairies. The date usually given for it is 1635. There is a wild love of play in it, and just a little pleasant mischief; but it is all bright and dainty, as fairy doings must be.

COME follow, follow me,
You fairy elves that be:
Which circle on the greene,
Come follow Mab your queene.
Hand in hand let's dance around,
For this place is fairye ground.

When mortals are at rest,
And snoring in their nest,
Unheard, and unespyed,
Through keyholes we do glide;
Over tables, stools and shelves,
We trip it with our fairy elves.

Upon a mushroome's head
Our tablecloth we spread;
A grain of rye or wheat
Is manchet, which we eat;
Pearly drops of dew we drink,
In acorn cups filled to the brink.

The grasshopper, gnat, and fly,
Serve for our minstrelsie;
Grace said, we dance a while,
And so the time beguile:
And if the moon doth hide her head,
The gloe-worm lights us home to bed.

On tops of dewie grasse
So nimbly do we passe,
The young and tender stalk
Ne'er bends when we do walk;
Yet in the morning may be seen
Where we the night before have been.

THERE'S A GOOD TIME COMING

This song, written by Charles Mackay, has the ring of downright sincerity and a wealth of homely wisdom. The "good time" he sang of has not yet come, but it is nearer, and more and more people feel it would indeed be a good time.

THERE'S a good time coming, boys,
A good time coming:
There's a good time coming, boys—
Wait a little longer.
We may not live to see the day,
But earth shall glisten in the ray
Of the good time coming.
Cannon-balls may aid the truth,
But thought's a weapon stronger;
We'll win our battle by its aid,
Wait a little longer.

CHORUS:

Oh, there's a good time coming, boys,
There's a good time coming:
There's a good time coming, boys,
Wait a little longer.

There's a good time coming, boys,
A good time coming:
The pen shall supersede the sword,
And right, not might, shall be the lord,
In the good time coming.
Worth, not birth, shall rule mankind,
And be acknowledged stronger.
The proper impulse has been given—
Wait a little longer.

There's a good time coming, boys,
A good time coming:
Hateful rivalries of creed
Shall not make their martyrs bleed,
In the good time coming.
Religion shall be shorn of pride,
And flourish all the stronger;
And Charity shall trim her lamp—
Wait a little longer.

There's a good time coming, boys,
A good time coming:
War in all men's eyes shall be
A monster of iniquity,
In the good time coming.
Nations shall not quarrel then
To prove which is the stronger,
Nor slaughter men for glory's sake—
Wait a little longer.

THE WEAKEST THING

Elizabeth Barrett Browning, who wrote this lovely little poem, did not aways succeed in being musical in her choice of words, but she succeeds daintily here while depicting the moods to which our hearts are subjected. Poets often put into their songs a deep undertone of meaning, besides that which appears plain on the surface, and it may be so here in the last verse, with God, the moving heart of all things, strengthening our weak hearts in their need.

WHICH is the weakest thing of all
Mine heart can ponder?
The sun, a little cloud can pall
With darkness yonder;
The cloud, a little wind can move
Where'er it listeth;
The wind, a little leaf above,
Though sere, resisteth.

What time that yellow leaf was green,
My days were gladder;
But now, whatever spring may mean,
I must grow sadder.
Ah me! a leaf with sighs can wring
My lips asunder—
Then is mine heart the weakest thing
Itself can ponder.

Yet, Heart, when sun and cloud are pined
And drop together,
And at a blast which is not wind,
The forests wither,
Thou, from the darkening deathly curse,
To glory breakest—
The Strongest of the universe
Guarding the weakest!

HAPPINESS

It is not always easy to keep cheerful when things go wrong, but the author of these few lines suggests that happiness comes to those who try each day to be helpful, loyal, kind, and true.

JUST to be tender, just to be true;
Just to be glad the whole day through;
Just to be merciful, just to be mild;
Just to be trustful as a child;
Just to be gentle and kind and sweet;
Just to be helpful with willing feet;
Just to be cheery when things go wrong;
Just to drive sadness away with a song;
Whether the hour is dark or bright,
Just to be loyal to God and right!

TO THE RIVER CHARLES

Longfellow, the American poet, as has often been pointed out, loves to celebrate in verse scenes of natural beauty, and if we go through his poems we shall find that almost everywhere he traveled or lived during his life he found some subject to write about in the rivers, mountains, towns, or castles. The River Charles, of which he sings in this poem, is a stream that flows into the sea at Boston Harbor.

RIVER that in silence windest
Through the meadows, bright and free,
Till at length thy rest thou findest
In the bosom of the sea.

Four long years of mingled feeling,
Half in rest, and half in strife,
I have seen thy waters stealing
Onward, like the stream of life.

Thou hast taught me, silent river,
Many a lesson deep and long;
Thou hast been a generous giver,
I can give thee but a song.

Oft in sadness, and in illness,
I have watched thy current glide
Till the beauty of its stillness
Overflowed me, like a tide.

And in better hours and brighter,
When I saw thy waters gleam,
I have felt my heart beat lighter,
And leap onward with they stream.

Not for this alone I love thee,
Nor because thy waves of blue
From celestial seas above thee
Take their own celestial hue.

Where yon shadowy woodlands hide thee,
And thy waters disappear,
Friends I love have dwelt beside thee,
And have made thy margin dear.

THE BUTTERFLY AND THE SNAIL

Elsewhere one of the fables in verse by John Gay is printed. Another poem of the same kind by that author is here given. In this class of poetry there is very little scope for originality, either of thought or form. Fables in verse are very much alike, but, if they are as well written as those of Gay, they never tire the reader, and, even when the "moral" is an old one, it has the enduring value of a good sermon, which, as we know, can be preached more than once.

AS in the sunshine of the morn
A butterfly (but newly born)
Sat proudly perking on a rose,
With pert conceit his bosom glows;
His wings (all glorious to behold)
Bedropt with azure, jet, and gold,
Wide he displays; the spangled dew
Reflects his eyes and various hue.
His now forgotten friend, a snail,
Beneath his house, with slimy trail,
Crawls o'er the grass, whom when he spies,
In wrath he to the gardener cries:
"What means yon peasant's daily toil,
From choking weeds to rid the soil?
Why wake you to the morning's care?
Why with new arts correct the year?
Why grows the peach's crimson hue?
And why the plum's inviting blue?
Were they to feast his taste design'd,
That vermin of voracious kind?
Crush then the slow, the pilfering race,
So purge thy garden from disgrace."
"What arrogance!" the snail replied;
"How insolent is upstart pride!
Hadst thou not thus, with insult vain
Provok'd my patience to complain,
I had conceal'd thy meaner birth,
Nor trac'd thee to the scum of earth;
For scarce nine suns have wak'd the hours,
To swell the fruit, and paint the flowers,
Since I thy humbler life survey'd,
In base, in sordid guise array'd.
I own my humble life, good friend;
Snail was I born and snail shall end.
And what's a butterfly? At best
He's but a caterpillar drest;
And all thy race (a numerous seed)
Shall prove of caterpillar breed "

BIG AND LITTLE THINGS

Mr. Alfred H. Miles, who has compiled an important work entitled "The Poets and Poetry of the Nineteenth Century," is himself a poet of no mean ability, and has written much that is suitable for grown-ups as well as for children. We have chosen here one of his pieces for young people, which conveys a useful lesson in clear and familiar language.

I CANNOT do the big things
That I should like to do,
To make the earth for ever fair,
The sky for ever blue.

But I can do the small things
That help to make it sweet;
Tho' clouds arise and fill the skies.
And tempests beat.

I cannot stay the raindrops
That tumble from the skies;
But I can wipe the tears away
From baby's pretty eyes.

'I cannot make the sun shine,
Or warm the winter bleak;
But I can make the summer come
On sister's rosy cheek.

I cannot stay the storm clouds,
Or drive them from their place;
But I can clear the clouds away
From brother's troubled face.

I cannot make the corn grow,
Or work upon the land;
But I can put new strength and will
In father's busy hand.

I cannot stay the east wind,
Or thaw its icy smart;
But I can keep a corner warm
In mother's loving heart.

I cannot do the big things
That I should like to do,
To make the earth for ever fair,
The sky for ever blue.

But I can do the small things
That help to make it sweet;
Tho' clouds arise and fill the skies
And tempests beat.

LITTLE VERSES FOR VERY LITTLE PEOPLE

THE man in the wilderness asked me,
How many strawberries grew in the sea?
I answered him, as I thought good,
As many red herrings as grew in the wood.

PEG, Peg, with a wooden leg,
Her father was a miller;
He tossed the dumpling at her head,
And said he could not kill her.

I HAD a little moppet,
I put it in my pocket,
And fed it with corn and hay,
There came a proud beggar
And swore he would have her,
And stole my little moppet away.

SIMON BRODIE had a cow;
He lost his cow and could not find her;
When he had done what man could do,
The cow came home and her tail behind her.

THE King of Clubs, he often drubs
His loving Queen and wife.
The Queen of Clubs returns his snubs,
And all is noise and strife.
The Knave of Clubs gives winks and rubs,
And swears he'll take her part!
For when our kings will do such things,
They should be made to smart.

The Diamond King I fain would sing,
And likewise his fair Queen,
But that the Knave, a haughty slave,
Must needs step in between.
"Good Diamond King, with hempen string
This haughty Knave destroy!
Then may your Queen, with mind serene,
Your royal love enjoy."

The King of Spades he kissed the maids,
Which grieved the Queen full sore;
The Queen of Spades, she beat those maids
And turned them out of door.
The Knave of Spades grieved for those jades,
And did for them implore;
The Queen so gent, she did relent,
And vowed she'd strike no more.

MARY had a pretty bird,
Feathers bright and yellow;
Slender legs—upon my word,
He was a pretty fellow.
The sweetest note he always sung,
Which much delighted Mary;
She often, where the cage was hung,
Sat hearing her canary.

THE Robin and the Wren
Fought about the porridge-pan;
And ere the Robin got a spoon,
The Wren had ate the porridge down.

ON Saturday night
Shall be all my care
To powder my locks
And curl my hair.

On Sunday morning
My love will come in,
When he will marry me
With a gold ring.

TWO little dogs sat by the fire,
Over a fender of coal-dust;
When one said to the other dog,
"If Pompey won't talk, why, I must."

AS little Jenny Wren
Was sitting by the shed,
She waggled with her tail,
And nodded with her head.

She waggled with her tail,
And nodded with her head,
As little Jenny Wren,
Was sitting by the shed.

HUSH, baby my dolly, I pray you don't cry,
And I'll give you some bread and some milk by-and by;
Or perhaps you like custard, or may be a tart,
Then to either you're welcome, with all my heart.

GREAT A, little a, bouncing B,
The cat's in the cupboard and she can't see.

HEY diddle, dinkety, poppety, pet,
The merchants of London they wear scarlet;
Silk in the collar, and gold in the hem,
So merrily march the merchantmen.

TRIP UPON TRENDIES

Trip upon trendies, and dance upon dishes,
My mother sent me for some barm, some barm;
She bid me tread lightly, and come again quickly,
For fear the young men should do me some harm.
Yet didn't you see, yet didn't you see,
What naughty tricks they put upon me?
They broke my pitcher, and knocked me down,
And huffed my mother, and tore my gown,
And kissed my sister instead of me!

THE EMPEROR WALKED IN THE PROCESSION

The emperor walked under his high canopy in the midst of tne procession, and all the people cried out: "On, how beautiful are the emperor's new clothes!" "But the emperor has nothing on!" said a little child.

THE EMPEROR'S NEW CLOTHES

CONTINUED FROM 3623

MANY years ago, there was an emperor who was so fond of new clothes that he spent all his money in dress. He did not trouble in the least about his soldiers; nor did he care to go either to the theatre or the chase, except that they gave him opportunities for displaying his new clothes. He had a different suit for each hour of the day; and instead of saying of him: "He is sitting in council," people always said: "The emperor is sitting in his wardrobe."

Time passed away merrily in the large town which was his capital; strangers arrived every day at the court. One day, two rogues, calling themselves weavers, made their appearance. They announced that they knew how to weave stuffs of the most beautiful colors and elaborate patterns, the clothes manufactured from which should have the wonderful power of remaining invisible to everyone who was unfit for the office he held, or who was extraordinarily simple in character.

"These must indeed be splendid clothes!" thought the emperor. "Had I such a suit, I might at once find out what men in my realm are unfit for their office, and also be able to distinguish the wise from the foolish. This stuff must be woven for me immediately." And he ordered large sums of money to be given to both the weavers, so that they might begin their work directly. So the two pretended weavers set up two looms, and appeared to work very busily, though in reality they did nothing at all. They asked for the most delicate silk and the purest gold thread, put both into their own knapsacks, and then continued their imaginary work at the empty looms until late at night.

"I should like to know how the weavers are getting on with my cloth," said the emperor to himself, after some little time had elapsed. He was, however, rather embarrassed, when he remembered that a simpleton, or one unfit for his office, would be unable to see the manufacture. "To be sure," he thought, "I have nothing to risk in my own person; but yet I would prefer sending somebody else to bring me news about the weavers and their work, before I trouble myself in the affair."

All the people throughout the city had heard of the wonderful power the cloth was to possess; and all were anxious to learn how wise, or how ignorant, their neighbors might prove to be.

"I will send my faithful old minister to the weavers," said the emperor at last; "he will be best able to see how the cloth looks; for he is a very sensible man, and no one can be more suitable for his office than he is."

So the faithful old minister went into the hall, where the knaves were apparently working with all their might at their empty looms.

"What can be the meaning of this?" thought the old man, opening his eyes very wide. "I cannot discover the least bit of thread on the looms!"

However, he did not express his thoughts aloud.

The impostors requested him to be so good as to come nearer their looms, and then asked him whether the design pleased him, and whether the colors were not very beautiful, at the same time pointing to the empty frames. The poor old minister looked and looked, but he could not discover anything on the looms, for a very good reason—there was nothing there.

"What!" thought he again, "is it possible that I am a simpleton? I have never thought so myself; and, at any rate if I am so, no one must know it. Can it be that I am unfit for my office? No, that must not be said either. I shall never confess that I could not see the stuff."

"Well, sir minister," said one of the knaves, still pretending to work, "you do not say whether the stuff pleases you."

"Oh, it is admirable!" replied the old minister, looking at the loom through his spectacles. "This pattern, and the colors—I will tell the emperor how very beautiful I think them."

"We shall be much obliged to you," said the impostors; and then they named the different colors and described the patterns of the pretended stuff. Then the knaves asked for more silk and gold, saying that it was necessary to complete what they had begun. They eagerly took all the expensive materials given them, and hid the goods in their knapsacks, and continued to work with as much apparent diligence as before at their empty looms.

The emperor now sent another officer of his court to see how the men were getting on, and to find out whether the cloth would soon be ready. It was just the same with this gentleman as with the minister; he surveyed the looms on all sides, but could see nothing at all but the empty frames.

"Does not the stuff appear as beautiful to you as it did to my lord the minister?" asked the impostors of the emperor's second ambassador.

"I certainly am not stupid!" thought the messenger. "It must be that I am not fit for my good, profitable office! That is very odd; however, no one shall know anything about it." And accordingly he praised the stuff he could not see, and declared that he was delighted with both colors and patterns. "Indeed, please your Imperial Majesty," said he to his sovereign, when he returned, "the cloth which the weavers are preparing is extraordinarily magnificent."

And now the emperor himself wished to see the costly manufacture, while it was still on the loom. Accompanied by a select number of officers of the court, among whom were the two honest men who had already admired the cloth, he went to the crafty impostors, who, as soon as they were aware of the emperor's approach, went on working more diligently than ever, although they still did not pass a single thread through the looms.

"Is not the work absolutely magnificent?" said the two officers of the crown already mentioned. "If your Majesty will only be pleased to look at it! What a splendid design! What glorious colors!" And at the same time they pointed to the empty frames, for they imagined that everyone but themselves could see this exquisite piece of workmanship.

"How is this?" said the emperor to himself. "I can see nothing. This is indeed a terrible affair! Am I a simpleton, or am I unfit to be an emperor? That would be the worst thing that could happen. . . . Oh, the cloth is charming!" said he aloud. And he smiled most graciously, and looked closely at the empty looms, for on no account would he say that he could not see what two of the officers of his court had praised so much. All his retinue now strained their eyes hoping to discover something on the looms, but they could see no more than the others. Nevertheless, they all exclaimed; "Oh, how beautiful!" and advized his Majesty to have some new clothes made from this splendid material for the procession that was going to take place very soon. The two rogues sat up the whole of the night before the day on which the

procession was to take place, and had sixteen lights burning, so that everyone might see how anxious they were to finish the emperor's new suit. When the day arrived, they came to the palace with huge boxes.

"If your Imperial Majesty will be graciously pleased to have your clothes taken off we will fit on the new suit in front of the looking-glass," they said.

The emperor was accordingly undressed, and the rogues pretended to array him in his new suit, the emperor turning round, from side to side, before the looking-glass.

"How splendid his Majesty looks in his new clothes, and how well they fit!" everyone cried out. "What a design! These are indeed royal robes!"

"The canopy which is to be borne over your Majesty in the pageant is waiting," said the master of ceremonies.

"I am quite ready," answered the emperor. "Do my new clothes fit well?" asked he, turning himself round again before the looking-glass, in order that he might appear to be examining his handsome suit.

The lords of the bed-chamber, who were to carry his Majesty's train, felt about on the ground as if they were lifting up the ends of the mantle, and pretended to be carrying something, for they would by no means betray anything that looked like simplicity, or unfitness for their office.

So now the emperor walked under his high canopy, in the midst of the procession, through the streets of his capital; and all the people standing by, and those at the windows, cried out: "Oh, how beautiful are the emperor's new clothes! What a magnificent train there is to the mantle; and how gracefully the scarf hangs!" In short, no one would admit that he was unable to see these much-admired clothes.

WHEN THE DAY ARRIVED THE ROGUES CAME TO THE PALACE WITH HUGE BOXES

"But the emperor has nothing on!" said a little child. "Listen to the voice of innocence!" exclaimed his father. And what the child had said was whispered from one to another.

"But he has nothing on!" at last cried out all the people. The emperor was vexed, for he knew that the people were right. And at last, believing that he was really unfitted for his throne, he resolved to give up trivial things and rule his kingdom well. The weavers, fearing to be punished, fled and were forgotten, and the emperor and his people lived in happiness for many, many years.

SCRAMBLEPIPE TRIES TO UNDERSTAND

THE GNOMES WHO SET OUT FOR CHRISTMAS AND FOUND THAT THE WORLD IS ROUND

IT was the twenty-fourth of June. The twenty-fourth of June is Midsummer Day. Screwworm said to Scramblepipe: "Christmas is coming."

Every gnome had a vast respect for Screwworm. When Screwworm spoke, everybody listened. When Screwworm asked a question, everybody thought, reflected, took a turn round the garden, or sat with their heads in cold water, before making an answer. Screwworm, in short, was immensely wise.

Now, the only gnome who was not in his heart convinced of Screwworm's wisdom was Burrowjack. Burrowjack was a gay little fellow. Once a week he had a punning day. It was the same day as Mrs. Burrowjack's washing-day. She filled the house with steam; he filled the air with puns.

When Screwworm said to Scramblepipe on Midsummer Day, "Christmas is coming," Scramblepipe immediately leaned his brow upon his hand and plunged into profoundest thought. He knew that there was something deep in the idea. Screwworm had uttered it.

Burrowjack, who was sitting on a toadstool outside the cave, blowing bubbles with soap-water from his wife's wash-tub, pricked up his ears and listened.

"I can't get it," said Scramblepipe, after a long meditation. "I'm sorry, Screwworm; it's stupid of me, but I can't get it. *Christmas is coming.* No; I don't follow you. Perhaps if I went out, took a Turkish bath, and lay down for an hour or two, it might come to me and I might understand."

"*There isn't time*," said Screwworm. "Scramblepipe, make yourself easy. This is not a usual thought. It surprises *me*. It's TREMENDOUS!"

"Then I give it up," said Scramblepipe, with a grateful sigh.

"It is, if I may say so," said Screwworm, "one of those ideas which come to the brain of only the wisest, and that only once in a million years. Be quite easy, Scramblepipe, but reverent; I will explain. Christmas is coming *because summer is going*. If summer is going, Christmas must be coming. Now, in a certain sense, it may be argued that, while summer is here, Christmas cannot be here, too. But that is not my point. Summer undoubtedly is here, as much here as any one thing can ever be said to be here at all. But, what is Here? Have you ever seen Here? Have you ever taken it in your hands, examined it, punched its head, heard it squeak, or counted its waistcoat buttons? *Has it got waistcoat buttons?* We are in profound ignorance. Scramblepipe, I will let you into a secret. I don't believe there is any such thing as Here."

"It's coming to me," said Scramblepipe thoughtfully.

"Now, if Christmas is coming," continued Screwworm, "it is something that is alive and real. Far from going, it is coming. The two movements are as different as life and death. If summer is going, it is something mortal; if Christmas is coming, it is something immortal. If we stay here waiting, while something is going, we shall be left."

"Oh, I feel as if I am being tickled all over!" exclaimed Scramblepipe, interrupting. "I've nearly got it, nearly, almost, practically got it; but not quite. It eludes me, just as I think I'm certain of it."

"A thing that is going is ceasing to be; a thing that is coming must exist, to be coming," said Screwworm.

Scramblepipe leaped to his feet.

"Got it! Got it!" he cried excitedly. He began to dance—singing, grinning, laughing, cackling, and whistling. Suddenly, he stopped dead, his face livid. "Screwworm," he said, "it has gone!"

"My point," said old Screwworm, "is this: a thing that is coming must have a place from which to come. If, instead of waiting for that thing to come, we go to the place from which it is coming, shall we not be in the possession of something that is never going at all? In other words, if——"

Scramblepipe buried his head in his hands.

"Come with me," said Screwworm kindly; "I will show you what I mean." They rose up and went out together.

"Can you tell me," said Burrowjack, "who bade the field farewell? I am speaking of the bird. Say it over slowly to yourselves, thus: Who—bade—the field—fare—well."

For many days and nights these intrepid explorers journeyed across the earth to find Christmas. Weeks and months passed. Their clothes were in rags, their shoes were worn to shreds, their legs

BURROWJACK WAS SITTING ON A TOADSTOOL OUTSIDE THE CAVE BLOWING BUBBLES

were so stiff that they could scarcely lift their feet. But still they journeyed on.

"Courage!" said Screwworm, "courage! All we need is courage."

"It's certainly a splendid idea of yours," said Scramblepipe. "It takes time to come to it; but it's a magnificent idea!"

"His mother," said Screwworm, "for no one else would take the trouble to do so."

"No," replied Burrowjack. "Beautifully no. The answer is Adieu drop."

"Burrowjack," said Screwworm, "leave this silly jesting, and hear my words. We go to discover Christmas."

One day they arrived at a place where snow was falling. Their eyes shone with enthusiasm as they saw it.

"I feel," said Screwworm, "like a king approaching his coronation. Columbus discovering America is not nearly big enough for my feelings."

Above this white earth the sky was glittering with stars. An immense moon shone through the trees.

"The moon looks very different," said Screwworm.

"There's no man in it, for one thing," said Scramblepipe; "it smells different."

SCREWWORM AND SCRAMBLEPIPE SUDDENLY FOUND THAT THEY HAD ARRIVED AT HOME

"I never saw such a splendid country in my life!" exclaimed Scramblepipe.

"You can feel the very air is Christmas, can you not?"

"I can smell it!" cried Scramblepipe, with enthusiasm.

They traveled on. Night fell. The whole earth was buried under snow.

They traveled on and on until suddenly they heard a horn blow in the distance.

Screwworm fell on his knees. His face was dazzled with ecstasy. He waved his arms above his head.

"My idea!" he exclaimed. "My idea! I thought of it! Alone I got it! Oh, what it is to be a thinker!"

Scramblepipe cried:

"It is the horn of Christmas!"

Screwworm rose.

"This night the dream of my existence is realized. We have penetrated into the unknown. We have conquered Time. We are in the very land of Christmas!"

The horn blew again.

"Santa Claus is calling us!" said Scramblepipe.

They went on with joy.

"Think, Scramblepipe, think of that foolish Burrowjack, sitting on a toadstool, and waiting, *waiting* for Christmas to come to him!"

They rubbed their hands and laughed.

At last, they came to the place from which the horn had sounded. They started and turned a little pale.

"I seem to know this spot," said Scramblepipe suspiciously.

Screwworm admitted:

"It certainly has a miserably familiar look about it."

"Why," cried Scramblepipe, "it's old Cuddledick blowing the horn!"

"It certainly looks like it," said Screwworm, whose face was green.

"My dear old boy," exclaimed Scramblepipe suddenly, "do you know where we are?"

"I do."

"*We are at home!*"

"Too true!"

"Home—in our own land, in our own country, in our own territory, in our own neighborhood!"

They entered the cave, and sat down.

"Hallo!" said Burrowjack. "Where have you been? Oh, I forgot! You've been to Christmas. How did you find the old gentleman?"

"Gentlemen," said Screwworm, "I and Brother Scramblepipe have been upon a scientific exploration. We have made an amazing discovery. I will tell it you."

"Not at Christmas! Not at Christmas!" pleaded all the gnomes, holding their heads. But Screwworm heeded not their pleading.

"Gentlemen," he said, solemnly and mercilessly, "the World is Round!"

THE KING, THE NOBLEMAN, & THE PEASANT

IT came one day to the ears of Louis XII. of France that a certain nobleman had very brutally chastised a peasant. As the king was called "Father of his people," and was truly beloved by all his subjects for the great benevolence of his heart, it can be imagined how this story would vex and distress him. He determined to teach the nobleman a lesson as to how he should treat those who were less fortunate than himself. But he kept this purpose secret. For several weeks he considered the matter, and at last he hit on a plan which he thought would be effectual.

One day he invited the nobleman to his palace, and kept him to dinner. He did not himself dine with his guest, but he ordered the most magnificent banquet imaginable to be served to the lord. Everything good to eat that you can possibly think of was placed on the gorgeous table, with the single exception of bread, which, by the king's express command, was not placed there. The nobleman was, of course, very much surprised by this strange omission, but he dared not, out of courtesy, ask for so small and common a thing with so many rare and delicate dishes spread before him. But, of course, as the banquet progressed, the more did he feel the lack of bread, till towards the end of the feast he was almost enraged by the absence of such a necessary thing.

At this moment the monarch entered the hall.

"My lord," said the king to his guest, "have they provided you with good fare?"

"Sire," answered the nobleman, "they have served a superb feast, a feast fit for a king. And yet, notwithstanding that, to tell your Majesty the truth, I do not seem to have dined well; for, in order to live, bread is necessary, and of bread at this banquet there was none."

"Go," responded Louis XII. in a tone of great severity; "and therefore shall you the better understand the lesson I desired to impress upon your heart. As you need bread, my lord, in order to satisfy yourself, learn at least to treat with common humanity those whose labor it is to make it grow that you may be supplied."

BACK FROM THE SOUTHERN SEAS

In this picture by Edgar Bundy, R.I., we see an English sailor returned to London after his many adventures in the Southern Seas and the Spanish Main, where he has been a captive of the Spaniards. He is relating his adventures to a company of English gentlemen engaged in the business of foreign trade and adventure. Though not drawn to illustrate "Westward Ho!" the picture is clearly suggested by the story.
This picture is from the painting by Edgar Bundy, R.I., by permission of the artist.

THE STORIES OF CHARLES KINGSLEY

CHARLES KINGSLEY wrote "Westward Ho!" mainly, as he says himself, to commemorate those early days of England's naval and commercial glory, when, under the wise rule of Queen Elizabeth,England's enterprize was spreading and taking root in distant seas and distant lands. Spain was the most powerful of European nations at that period, and her ambition was to be mistress of the world, especially of England. But England's seamen, chiefly the men of Devon, put an end for all time to such designs when they routed the great Armada in 1588. Kingsley was himself a Devon man, so it was natural that he should make his hero a Devonian. His story of Devonshire worthies and their Spanish foemen is as lifelike as anything in the whole range of English historical fiction—hearty, free, strong, and tender. It reveals in a peculiar way the English Protestant hatred of the Spaniards, but here the story is "the thing."

WESTWARD HO!

CONTINUED FROM 3037

THE hero of our tale is a certain Devonshire youth named Amyas Leigh. We meet him first in his native Bideford, that little white town standing so pleasantly among the beautiful scenery of North Devon, beneath its soft, Italian sky, fanned day and night by the fresh ocean breeze. In the days of our story, Bideford was one of the chief ports of England. It furnished seven ships to fight the Armada; and even more than a century afterwards, as the old historians tell us, it "sent more vessels to the northern trade than any port in England, saving London and Topsham."

It is to the sea life and labor of Bideford, and Dartmouth, and Topsham, and Plymouth—then a very insignificant place—and many another tiny western town, that England owes the foundation of her naval and commercial glory. It is the men of Devon—the Drakes and Hawkins, the Gilberts and Raleighs, the Grenvilles and Oxenhams, and a host more of forgotten worthies—to whom England owes her commerce, her colonies, nay, her very existence. For had they not first crippled, by their West Indian raids, the ill-gotten resources of the Spaniard, and then crushed his last effort in the glorious Armada fight, what had England been now? Probably not the Britannia that is known as the Mother of Nations.

Well, Amyas Leigh, being a Bideford boy, saw a lot of sailors and ships, and, being fond of adventure, he longed to go to sea. He wanted especially to see the Indies, and to fight the Spaniards. He said so to a group of weather-beaten mariners whom he came across one fine summer afternoon in the year 1575.

He was just fifteen then, but for some time past, on account of his extraordinary size and strength, he had been the undisputed cock of the school, and the most terrible fighter among the Bideford boys. He was the terror of all the sailor lads, and the pride and stay of all the town's boys and girls, and hardly considered that he had done his duty if he went home without beating a big lad for bullying a little one. For the rest, he had no ambition beyond pleasing his father and mother, who were of gentle blood, as the saying is, and going to sea when he was old enough.

As yet, he had said nothing to his parents about his darling wish. But now, when Captain John Oxenham, the leading speaker in the above-mentioned sailor group, told of his purpose to fit out a ship to go in search of treasure in the West, and invited recruits, Amyas decided that his parents must know of his desire. It was arranged that Oxenham should come to a little supper, and

broach the matter to the Leighs. Sir Richard Grenville was there too—that same hero who fought the Revenge against such terrible odds, as we know from all the naval histories, and from Tennyson's stirring poem on the subject.

OUR HERO GOES TO SCHOOL WITH A PROMISE OF ADVENTURE

The Leighs were naturally opposed to their boy going to sea so early, especially as his elder brother, Frank, was already far away in a foreign land, and appealed to Sir Richard, who himself talked to the boy.

"Come now," he said to Amyas, "I will make you a promise. If you bide quietly at home and learn from your father and mother all which befits a gentlemen and a Christian, as well as a seaman, the day shall come when you will sail with Richard Grenville himself, or with better men than he, on a nobler errand than gold-hunting on the Spanish Main."

And thus Amyas Leigh, cheered by the prospect here held out to him, went back to school; while Mr. Oxenham proceeded to Plymouth without him, and so off to the boundless West, never more to be heard of, as it turned out.

But one never knows what a restless, adventurous youth with the sea-call in his ears will do. Amyas Leigh did not remain long at school. One day the master, Sir Vindex Brimblecombe, having reprimanded him, received from the pupil a smacking blow with a slate on his bald head. When Vindex recovered sufficiently, Amyas had to be switched. Amyas did not like it, so he went straight away to Sir Richard Grenville to take counsel with him about the sea project. Amyas had lost his father by this time, and Grenville had, in a manner, taken the father's place.

AMYAS SETS OUT FOR THE SPANISH MAIN UNDER SIR FRANCIS DRAKE

It was quite clear to Sir Richard that nothing was to be done now but let Amyas have his way. So Amyas presently found himself riding joyfully towards Plymouth by the side of Sir Richard, and being handed over to the famous Captain Drake, whose name was already, by reason of his adventures, the terror of the Spanish Indies.

Three years passed, during which Amyas Leigh was not seen in his native Bideford. He had been round the world with Drake—literally round the world. In those days that was an achievement something like what we regard a journey across the Antarctic continent now. So when Amyas and the other Devon men who had been with him returned in safety, Bideford held a public thanksgiving, made a holiday for the occasion, and had its streets turned into a very flower garden of all the colors, swarming with seamen and burghers and burghers' wives and daughters, all in their holiday attire. That was how Amyas Leigh came home the first time. As they saw him in the church, he was still a beardless boy, yet with the frame and stature of a Hercules; like Saul of old, a head and shoulders above all the congregation, with his golden locks, flowing down over his shoulders. He would have good use for that strength and that figure by-and-by, as we shall see.

HOME AGAIN FROM HIS FIRST VOYAGE OF ADVENTURE, AMYAS FALLS IN LOVE

Meanwhile he fell in love. The lady was Rose Salterne, the Mayor of Bideford's daughter, a beautiful girl of eighteen, about whom the half of North Devon had gone crazy. Amyas had a rival in his brother Frank, now at home, a tall, slim fellow of twenty-five. And he had a rival, too, in his cousin Eustace, a religiously inclined person, who had been Catholic and Protestant in turn, like the Vicar of Bray, celebrated in song, but now, in the reign of Protestant Elizabeth, was finally settled in the older faith. Eustace went to the length of proposing to Rose, but Rose rejected him. She was a fine specimen of a West-country maiden, full of passionate, impulsive affections, and wild, dreamy imaginations—a fit subject for all romantic and gentle superstitions. She had no wish to break hearts; but her admirers were all very charming, and no one of them was very much better than the others. So she kept them all dangling, as it were, and Amyas Leigh had no more favor with her than the rest, notwithstanding that he *was* so madly in love.

But, in truth, Amyas had more serious work on hand than love-making, as we shall see presently. Just now he had to help, with Sir Richard Grenville, in the capture of some intriguing Jesuits. And then came an entrancing experience when, in Grenville's presence, he

listened eagerly to "the true and tragical story of Mr. John Oxenham," as told by Salvation Yeo. Salvation Yeo makes a great figure in our tale. He was a tall, gaunt fellow, with a florid, black-bearded face. Amyas had encountered him long ago among that group of sailors on Bideford Quay. He was then dressed in a suit of crimson velvet. By his side were a long Spanish rapier and a brace of daggers. His fingers sparkled with rings, and he had two or three gold chains about his neck, and large ear-rings in his ears. A man, once seen, to be remembered for ever.

Like Drake, Salvation Yeo was full of the conviction that, in fighting the Spaniards, he was fighting for the cause of freedom, of England, and of God. And, as we shall not mention him again, let us take it for granted that, when he goes out adventuring with Amyas, as he does, he takes a big share in the fighting, and goes through with it in his own sturdy, rough, masterful way.

THE STIRRING STORY TOLD BY SALVATION YEO

And what a story that was he told to Grenville and Amyas! It was all about Oxenham's adventure and his tragic end—for Yeo had gone as gunner on that same expedition in which our young hero had so wished to have a part. Yeo had helped to get the crew of seventy men together. And now, clasping his hands on his breast, he exclaimed to Grenville: "Those seventy men, sir—seventy gallant men, sir, with every one of them an immortal soul within him—where are they now? Gone, like the spray! And their blood is upon my head!" Oxenham had called his men together one day. "I tell you now," he said, "what I forbore to tell you at first, that the South Seas have been my mark ever since I left Plymouth. Such news have I of plate-ships and gold-ships, and what not, all which, with the pearls of the Gulf of Panama, and other wealth unspeakable, will be ours if we have but true English hearts within us." At which, as Yeo confessed, the crew "were like madmen for lust of that gold, and cheerfully undertook a toil incredible." Alas! the Spaniards proved too much even for the brave English hearts. In that exciting hunt for gold and treasure many of Oxenham's men were slain; some died of hunger and some of disease. Oxenham himself and sundry more were hanged; while Salvation Yeo fell into the clutches of the Spanish Inquisition, to escape by-and-by, and tell that wonderful yarn, which would make a good long story by itself.

AMYAS LEIGH CAPTURES AN IMPORTANT PRISONER, DON GUZMAN

And now we must return to our hero proper. Sailing the Southern Seas was what Amyas Leigh preferred, but if that could not be done he would go fighting nearer home. It was now the year 1580, and the hated Spaniards were menacing Ireland. England had a Protestant sovereign, and the Spaniard wanted to claim Catholic Ireland as the Pope's gift to himself. His plea was that Elizabeth had forfeited her title to Ireland by heresy. Ireland has long had two great struggles, the religious struggle and the land struggle, and just now it was the religious struggle that was distressing that country.

But the Spaniard could not hold his own on British ground against the men of Devon, of whom our Amyas was one. At the end of a severe encounter Amyas brought in a captive. "He and I," he told his superior, "cut at each other twice or thrice, and then lost each other; and after that I came upon him among the sandhills trying to rally his men. But his men ran, so I brought him in."

Though Amyas did not know it, the prisoner was to play a very important part in his story. His name was Don Guzman. He was a very tall and graceful personage, golden-haired and fair-skinned, with hands as small and white as a woman's. The Don was Amyas's prize by right of war, but where to bestow him was the question.

AMYAS TIRES OF HIS LIFE IN IRELAND AND THIRSTS FOR NEW ADVENTURES

In the end, Sir Richard Grenville, having been communicated with on the matter, agreed to receive the Don as his own guest at Bideford till his ransom should arrive.

Meanwhile, Amyas, now a lieutenant, was left alone among the Irish bogs for two more years. Then, getting utterly sick of Ireland and the inactive life, he came home, determined on some adventure Westward Ho! As it happened, Sir Humphrey Gilbert, most pious and most learned of seamen and of cavaliers,

beloved and honored above all his compeers by Queen Elizabeth, was just fitting out an expedition for Newfoundland and Labrador, and Amyas went with him as a gentleman adventurer. Away they sailed to the West, the largest ship in the little squadron being only of 200 tons burden, the smallest of 10 tons. In such cockboats did these old heroes brave the unknown seas!

And it was in that small ten-ton boat that Gilbert lost his life. Amyas told the story of the setting sail from St. John's to discover the southward coast; of Gilbert's chivalrous determination to go in the tiniest craft, because she was more fit to examine the creeks; of the storms coming on; and of how at last the Squirrel, for that was her name, was devoured and swallowed up by the sea. The expedition had been an utter failure, and Amyas Leigh, though he had a good share of adventure by it, came home with a sad heart.

WHAT AMYAS DISCOVERED WHEN HE CAME HOME AGAIN, AND HIS NEW RESOLVE

But youth gets over most things, and Amyas got over this disappointment. There was another thing that he did not get over so quickly. He found that, during his absence, his old prisoner, the Señor Don Guzman, had been making love to Rose Salterne, and had finally vanished with her, no one knew whither or in what character, whether as husband or lover. Rose had not yielded to the Spaniard without a struggle. He had pleaded long with her before she agreed to go with him. But gone she was, and that was the point which concerned Amyas Leigh.

These were the days of romantic chivalry, when gallants would go out and fight for distressed ladies, as Don Quixote did. Now, more than one of Rose's disappointed suitors vowed that he would find her and slay the rival who had carried her off. Amyas was chief among them, but there were also his brother Frank, and Will Cary, and Jack Brimblecombe, the parson son of that Bideford schoolmaster whose skull had been so nearly fractured by Amyas. They were all bent on getting at Rose, and getting even with the Spaniard who had found favor in her eyes. Somebody brought the news that Don Guzman had been appointed Governor of La Guayra, on the Caribbean Sea, and had gone there with a lady for company. So, after consultation and long debate, it was decided that a ship should be fitted out and a crew got together, and away they would sail on the romantic expedition; Amyas, who was to be the leader, declaring that, if chance brought the Spaniards in his way, he would fight for his queen as well as for Rose Salterne.

AMYAS SETS SAIL IN THE ROSE ON A ROMANTIC EXPEDITION

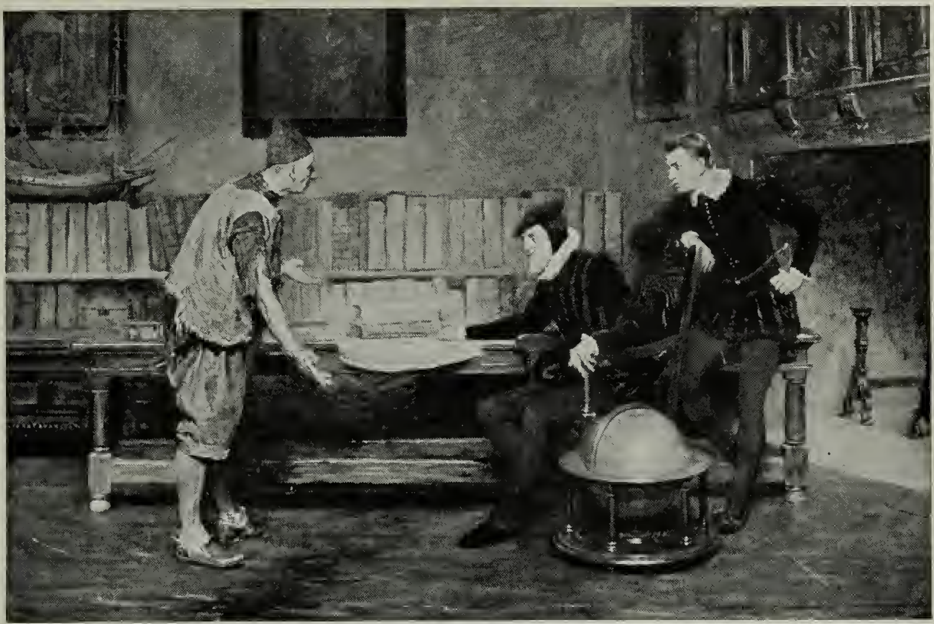
Rose's father wanted to be revenged on the Spaniard, too, for the Spaniard had carried off his daughter without his consent. Salterne was a man of means, and it was he who was largely responsible for the cost of the expedition. The ship was appropriately called the Rose. She was of 200 tons burden, and she had a crew of a hundred picked men, for sailors packed close in those days. She carried beef, pork, biscuit, and good ale in abundance, and was liberally provided with all the kinds of ammunition which were common at that time. In fact, when she dropped down from Bideford Quay on November 15, 1583, everybody allowed that so well-appointed a ship had never sailed "out over bar."

This was Amyas Leigh's great adventure, and we must tell about it in some detail. The first land sighted was Barbadoes—land at last, with fresh streams and cooling fruits and free room for cramped and scurvy-weakened limbs. There the good ship the Rose anchored for four days, to get her sick round, before her crew made for the Main, and set to their serious work.

THE ADVENTURERS AS PIONEERS OF BRITISH POWER IN THE WESTERN SEAS

Then they were off again to the westward, unconscious pioneers of all the wealth and commerce and beauty and science which has in later centuries made Barbadoes one of the richest gems of the tropic seas. By-and-by they slipped past the southern point of Grenada, and were within that fairy ring of islands on which Nature has concentrated all her beauty. Not more than five times before, perhaps, had those mysterious seas been ploughed by English keels; but there were those on board who knew them well, who had attempted, under Captain John Hawkins, to trade along

A STORY OF THE SPANISH MAIN



In Sir Richard Grenville's presence, Amyas Leigh listened to the "true and tragical tale of Mr. John Oxenham," as told by Salvation Yeo. Oxenham had sailed with Yeo and seventy men for treasure-hunting in the South Seas, but Yeo alone had returned to tell of their tragic fate. He had suffered many hardships, and had escaped from the clutches of the Spanish Inquisition. His story fired Amyas with a desire for adventure.
This picture is reproduced from the picture by Mr. Seymour Lucas, R.A., by permission of Mr. Mansergh.

those very coasts, and had, in true British fashion, won their markets bravely at the point of their swords. For the Rose, also, there was fighting to do. The first of it came when she touched at Margarita, the Isle of Pearls, then famous in all the cities of the Mediterranean and at the great German fairs. Lying in the roadstead was a Spanish man-of-war, as we would say, and three boats by her.

OUR HERO'S EXPEDITION WREST THEIR PRIZE FROM THE SPANIARDS

Now, it was a recognized law in those days that wherever British seamen found a Spaniard, they should fight him. So Amyas and his men went for the enemy, and in brave style. They scrambled up his sides, and the crew yielded at once, some falling on their knees, some leaping overboard; and the prize was taken. It was the first prize of the expedition, but it was a notable one, for ship and boats were full of goodly pearls which would bring a long figure in dear old England.

The men would gladly have hawked awhile round Margarita and Cubagua for another pearl prize. But Amyas, having, as he phrased it, "fleshed his dogs," was loth to hang about the islands any longer. Rose Salterne was ever in his mind, and he must now make straight for La Guayra. Soon they came within sight of the mighty range of the Caraccas Mountains, and one day more brought them to the port of La Guayra. Four thousand miles of sea had been crossed, and now they were at their destination.

AMYAS IS ON THE HEELS OF DON GUZMAN AT LAST

Just before reaching it, they had encountered an Indian in a boat, who warned them to avoid La Guayra altogether. "There are ships of war there waiting for you," said he; "and, moreover, the governor, Don Guzman, sailed to the eastward only yesterday to look for you!" Guzman? Ah, then he *was* really here! It was something to know so much. As for the ships of war, Amyas and his men would risk them. However, they found it a ticklish business. There, in the open roadstead, lay tossing at anchor five Spanish vessels, ugly-looking craft, at sight of which even the brave British hearts quailed. It was clearly impossible

to surprise the town which held the governor's house while these ships were there. The leaders of the expedition looked at each other with anxious, inquiring faces. What was to be done? Were the plans and hopes of months to be brought to nought in an hour? A council of war was held, and behold, while they talked, the sun plunged into the sea, and all was dark. And with the dark came a decision.

It was Frank Leigh who made it. He had identified the governor's house, and he declared that he would himself go off in a boat, proceed to the house, and have audience of Rose Salterne, of whose presence there he had no doubt. Protests were, of course, made against his going alone, and they drew lots to fix his companion. The lot fell upon Amyas. So the two brothers went off with a small picked crew, well armed. Reaching the pebble beach, the men were left with the boat, and the brothers started for the governor's house, with their swords only. They reached the house all right.

HOW AMYAS TRIED TO SAVE HIS BROTHER'S LIFE AND NEARLY LOST HIS OWN

But what did they find there? They found twenty negroes lying around the terrace in front. At present they were a sleeping guard, no doubt; but the slightest noise would waken them. One, in fact, wakened suddenly, and uttered a cry. Amyas dragged Frank down into the bushes, whispering: "Let us go back. We cannot go up without detection. Come back, for God's sake, ere all is lost." Just then, round the corner of the house a dark-cloaked figure stole gently, turning a look now and then upon the negroes, and came right towards them. It was Rose Salterne—no doubt about it. But what was that behind her? Another figure. Obviously it could not be Don Guzman, who was at sea. "It is Eustace, our cousin," exclaimed Amyas. "How came he here?" And Eustace it was. Eustace, remember, had been one of the rivals for Rose's hand, and he was, moreover, anxious to make her a convert to the Roman Catholic faith.

The brothers felt as if they should run their swords through him for this deception. They started up, and, in face of all danger, confronted the pair. Frank immediately made a wild appeal to Rose, who answered that she could face the chance of death, but not the loss of Don Guzman. At the same time Eustace was shouting for help, and the negroes sprang to their feet. Amyas pulled his infatuated brother down the hill only just in time; for the whole gang of negroes was within ten yards of them, in full pursuit. Every now and then, the brothers turned to menace them with their bright blades; but once on the rocky path, stones began to fly fast. Twenty yards now, and the boat would be reached. But what was that?

The dull crash of a stone against Frank's head. He sank on Amyas's arm. Amyas threw him over his shoulder, and plunged blindly on, himself struck again and again. "Fire, men! Give it the black villains!" he shouted to his crew. The arquebuses crackled from the boat in front. But there were dull thuds answering from behind. The governor's guard have turned out, and are firing at the hapless brothers, over the negroes' heads. If, as all say, there are moments which are hours, how many hours was Amyas Leigh in reaching that boat's bow? Alas! the negroes are there as soon as he, and the guard are close behind them. Amyas is up to his knees in water—battered with stones, blinded with blood. The boat is swaying off and on against the steep stony bank; he clutches at it—misses, falls headlong, rises half choked with water. Presently he is lying in the stern-sheets of the boat, and there is no Frank. So ended that fatal venture of mistaken chivalry.

It would take too long to tell of all the further adventures of the Rose and her men before Amyas returned home the third time. We should have to learn how he and his men slowly and painfully worked their way northward again; how they fraternised for a time with Indians whose chief food was ants and clay; how Amyas nearly lost his heart to a half wild, mysterious Indian girl; how the party crossed the Cordillera and captured a gold-train going down from Santa Fé towards the Magdalena; how they took a great Spanish galleon full of rich treasure; and how, at length, in the spring of 1587, they all found themselves once more among old scenes and old faces in the old

homeland, with "treasure untold," as Amyas said to his mother. They went out a hundred, and they came back forty-four. Where were the rest?

Their bones are scattered far and wide
By mount, and stream, and sea.

And what of Rose Salterne, she for whom this great adventure had been undertaken? Burned, alas! at the stake as a heretic; for she declined to give up her Protestant faith. That was the way the Spaniard dealt with "heretics" in those bad old days of religious bitterness.

THE TRAGIC FATE OF ROSE SALTERNE AND FRANK LEIGH

The very morning after that terrible night's encounter at La Guayra, Rose was seized and taken down to the quay, and shipped off to Cartagena. She was asked to recant and become a Catholic, but she remained firm. Three weeks afterwards she was brought out to her fate. And with her, in the ghastly procession, walked Frank Leigh, who had recovered from his wounds only to die by the fires of the Inquisition. These two, who had loved and lost, walked together now, and were burned at one stake. "They were both very bold and steadfast," said an eye-witness, "and held each other's hand to the very last."

When Amyas Leigh heard all the dreadful story, he vowed another oath, and it was this: that he would kill Spaniards, in fair fight, by land and sea, wherever he met them. The day was close at hand when Amyas could fight the Spaniards at home. For this was the year of the great Armada—that same 1588 which decided, once and for all, the fortunes of the European nations, and of the continent of America.

AMYAS IS CHEERED AT THE PROSPECT OF ENGAGING DON GUZMAN AFTER ALL

We all know the story of the twelve days' fight which closed with the complete rout of that vast armament which Philip II. sent to subdue England. All that concerns us about it here is the part played by our hero. Above and beyond his delight at fighting the Spaniards, he had the hope of encountering Don Guzman, his old rival. But it took him some time to find the St. Catherine, Don Guzman's ship, among all that array of craft. Day after day, in the protracted tussle, he sought for his prey. At last his quest was successful.

"Don Guzman!" he shouted, as he brought his own ship up against the Spaniard. "At your service, sir, whosoever you may be," was the reply. A dozen muskets and arrows were levelled at the Don, but Amyas frowned them down. "No man strikes him but I. Spare *him*, if you kill every other soul on board. Don Guzman! I am Captain Amyas Leigh; I proclaim you a traitor and a ravisher, and challenge you to single combat." "You are welcome to come on board me, sir," answered the Spaniard, "bringing with you this answer, that you lie in your throat." "Coward!" shouts Amyas. "Why that name of all others?" demands the Spaniard. "Because we call men cowards in England who leave their wives to be burned alive by priests."

HOW THE SPANIARD MET HIS FATE, BUT ELUDED AMYAS AT THE LAST

The Spaniard started, clutched his sword-hilt and tossed back; "For that word, you hang at my yard-arm if Saint Mary gives me grace." Then the fire began from both sides. Amyas poured in his shot till the Spaniard's sides were slit and spotted in a hundred places. But the Spaniard seemed invulnerable, and when night came she was still in a condition fit enough to rejoin her fellows. It seemed as if Amyas were to lose his prey after all. It would not be his fault if he did.

The Spaniards had gradually been losing ground, and in another day or two the "invincible" Armada, pommeled and riddled by the English, was seen in ignominious flight northward. Some part of the English fleet started after them, but had to give up for want of powder and shot. Amyas Leigh alone held on. He must have his revenge. Sixteen days passed, and still the chase went on. Then, just as Amyas was about to close with his enemy, a great storm arose, and the mighty St. Catherine, with 500 souls on board, plunged her yards into the foam, and vanished for ever, taking with her the man who had stolen the Rose of Bideford.

"Shame!" cried Amyas, hurling his sword far into the sea. "Shame! to lose my right, my right, when it was in my very grasp! Unmerciful!"

And that was the end of all Amyas Leigh's exciting adventures.

THE NEXT FAMOUS BOOKS ARE ON PAGE 3831.

THE SHRUNKEN RUSSIA OF TO-DAY

Russia has lost considerable territory and population since the World War. Finland is independent, and Esthonia, Latvia and Lithuania have set up their own governments. A part of Poland was Russian territory, and Rumania has gained a small corner. The Ukraine is not quite independent, and the three small republics across the Caucasus may become independent. All Russian boundaries may be changed.

The picture on page 3729 was painted by V. Verestchagin.

Early Russians fighting the Scythians, a fierce race of barbarians who lived round the Black Sea.

THE MAKING OF RUSSIA

CONTINUED FROM 3622

EUROPE and Asia, unlike the peninsula and island continents of the world that stand out distinct and alone, are practically parts of one vast mass of land whose western shores are washed by the Atlantic, and the eastern by the Pacific. We can trace one continuous belt of highlands right across Eurasia, as the united continents are often called, from the Alps to the mountains of the peninsula of Kamchatka; and the plain that lies between the White Sea and the Black Sea is continued far into Asia, round the base of the Ural Mountains. These mountains, too, being only about two thousand feet high, form no real barrier between Europe and Asia, either in the matter of climate or vegetation.

In all the stories of the western countries of Europe, we have read of their early inhabitants coming from Central Asia. Wave after wave of different peoples, for hundreds of years, rolled over this plain south of the Urals. They spread, as we have seen, over Europe, led by necessity or choice, to the extreme west, south, and north.

But some of all the various peoples and tribes decided to go no farther than the plain between the White and Black Seas, and settled there. Chief among them were the Finns, cousins of those whom we have seen driven north by the Scandinavians in Sweden, and the Slavs, cousins of those who settled between the Adriatic and the Black Sea. And the Slavs pushed the earlier inhabitants, the Finns, farther northwards, exactly as the Teutons did in Scandinavia. Now the chief features of this great plain are its splendid rivers and its great lakes. To the north is Lake Ladoga, the largest lake in Europe, and the land on the Baltic, where the Finns finally settled, has so many lakes that it is often called the Land of a Thousand Lakes. South of Lake Ladoga are the low Valdai Hills, where rises the mighty Volga, the largest river in Europe, that flows with a gentle current all its long course, till it runs into the Caspian Sea by numerous mouths. The Caspian Sea is the largest inland sea in the world.

The Dnieper and the Don, both long and important rivers, find their way across the plain, the Dnieper to the waters of the Black Sea, and the Don to the Sea of Azov. The early tribes settled on the land about these rivers that flow through wide, treeless plains called steppes, which are, in parts, rich with black earth and very fertile,

and in parts covered with grass for pasture land. Sometimes they are desert and rocky. Two of the oldest towns we know about in these regions are Kiev, on the Dnieper, and Novgorod, or Newtown, just north of the Valdai Hills, easy of access to both the Baltic and the Volga. And here we have the kernel of the country afterwards called Russia.

It was about a thousand years ago, so the old story says, that three bold Viking brothers were invited from Scandinavia to settle and rule in Novgorod. "Our land is great and bountiful," runs the old message, "but there is no order in it. Come and rule over us." This story reminds us of that of Hengist and Horsa settling in Kent, and it may be just about as true. Rurik, the chief of the brothers, in the end, gained sole power in the district, and founded a line of chiefs who gradually merged their Scandinavian nationality in that of the people whom they ruled, just as the Northmen did in France, and the Danes in England. But the old Norse daring showed itself when one of the chiefs hung his shield on the wall of Constantinople, and later when nothing but the terrible Greek fire, like lightning, could dislodge the ships that these adventurous and warlike Vikings brought.

Rurik, the daring Viking, who, with his two brothers, conquered a great part of Russia in the ninth century, and founded a line of princes, who ruled Russia for about 700 years.

Towards the end of the tenth century arose Vladimir, the first Christian ruler of the country, though, before his day, Queen Olga went to Constantinople to be baptized, and was called the "forerunner of Christianity in Russia, who shone in the midst of a heathen people." Vladimir also chose to belong to the Eastern, or Greek, Church, and ever since, for over 900 years, his country has kept faithful to that branch of the Church, and, indeed, has been its head since the cathedral of St. Sophia became a mosque, as we read on page 3187. Through the centuries it has often been able to hold out a helping hand to the smaller Slavonic countries, belonging to the same faith, when they were oppressed by their Mohammedan masters.

Vladimir insisted on his people being baptized in crowds, whether they wished it or not, just as happened under Clovis, as we read on page 2069. He was a conqueror too, adding both Slavonic and Finnish tribes, especially on the side of Poland. But he had no thought of uniting all as one nation, for, on his death, he divided his kingdom among his sons. One of these is remembered as the first great law-giver of Russia, and, in his code, we find how various crimes were punished by fines, and how trials were settled, as well as many other interesting details of life in Russia in this very early period of its romantic history. For about two centuries there now followed incessant civil wars. The custom of dividing up inheritances among several sons led to endless quarrels. Kiev was desolated by fire, Novgorod by famine. It was a gloomy time, and worse was to follow. In 1222 a new and terrible danger came from without. Once more, hosts from Asia came sweeping westwards over the great plains south of the Urals. As we have seen, there were no mountain fastnesses in which the people could gather to defend themselves against the cruel invaders; the cities were poorly fortified, so there was nothing to stop the onward rush of the host of Mongols or Tartars, who came plundering and destroying all in their path. Novgorod for a long time held its own; it belonged to the Hanseatic League, and had a great trade, and chose its own princes. "Who can contend with God and great Novgorod?" became

a proverb that showed its power and independence in those times. But elsewhere the Russian princes and dukes were obliged to pay homage to the Tartars, to furnish soldiers to fight for them, and to pay them heavy taxes. There was no national life at this time; all was depressed. Many strong and large monasteries were built up and down the country, whither people could retire for peace and safety; and to the labors of the monks, who lived in them, we owe the chronicles and the stories that have been handed down, and are of such deep interest to those who study the history of Russia. Some of the old stories are sung to-day, by wandering minstrels, about Vladimir, the "shining sun," and Queen Olga, and many others who helped their country.

THE BURNING OF MOSCOW CENTURIES BEFORE NAPOLEON WAS BORN

Among other cities burned by the Tartars, more than once, was Moscow, then a small town, but in a famous position on a sub-tributary of the Volga, midway between the White, the Baltic, the Black, and the Caspian Seas. Later, much of the history of the country centered round Moscow, the capital of the Muscovites, as Russians are sometimes called.

As time went on the Russian princes and nobles intermarried with the Tartars, and the Russians adopted from them many customs in manner and dress which they had brought from the East. Between Russia and the Baltic in those days were the Lithuanians, who remained heathen till the fourteenth century, and for a time they succeeded in holding some of the West Russian states and cities, including Kiev. Poland was united, too, to Lithuania for a time, and many struggles and quarrels arose, both with each other, and with the neighboring German states.

PRISONERS WHO WERE ROPED TOGETHER AND DRIVEN LIKE HERDS OF CATTLE

At the close of the fifteenth century the Russian princes succeeded in breaking up the Tartar power. The region on the northern shore of the Black Sea passed under the rule of the Turks, and was, for long, a bone of contention between them and their Russian neighbors, who were longing for ports and ships on this southern sea. Though the Tartars ceased, at this time, to be a terror to the country, their inroads continued for a century longer, and often miserable prisoners, roped together, might be seen passing over the steppes eastwards, driven along with captured herds of sheep and cattle.

We come now to a time when the Russian princes rapidly became stronger, and succeeded in getting more and more power into their own hands. There are two—Ivan III. and Ivan IV.—who stand out in the fifteenth and sixteenth centuries. Ivan III. crushed the liberties of Novgorod, and annexed many cities and states, refused to do homage to the Tartar khan, or ruler, and made alliances with surrounding countries. He married the niece of the last Greek emperor, Constantine, who was slain at the taking of Constantinople by the Turks. Many learned Greeks came in the train of the princess, bringing with them valuable manuscripts. These found safe housing in the monasteries, that were ever growing stronger and richer.

Moscow was rebuilt, and progress was made in many ways. This Ivan III., called the Great, is considered to be the founder of the state of modern Russia.

THE TRAVELERS TO RUSSIA WHO SALUTED A DYING BOY KING

From this time the double-headed black eagle, used by the Greek Empire, was adopted as the arms of Russia, and the title of tsar, or czar, by many thought to be derived from Cæsar, was assumed by her kings.

It was Ivan IV., a man of great power, though at times so insanely cruel that he is called the Terrible, who formally took the title of czar in 1547, after annexing many cities and states on the great plain, till his dominions reached to the south as far as Astrakhan, on the Caspian, and also to the north as far as the White Sea and Siberia.

So Russia began to spread into Asia, and, reaching the White Sea, it at last had a chance of trading with distant countries, even though its port was ice-bound for a great part of the year.

At the end of the reign of Edward VI. of England, an English captain, who was attempting to reach China by the northern route, entered the White Sea. He actually sailed into the Dwina, and went down through the country until he reached Moscow. He had a very hearty welcome, for Ivan was anxious to

trade, anxious to have workmen come to his country from the west; and the king of Poland, being his bitter enemy, would allow no passage through his dominions. In spite of a most disastrous voyage home, the desired communication was opened up by way of the Arctic Ocean, and a Russian ambassador and his suite, in gorgeous coats of velvet, with fringes of silk and chains of gold, made a splendid entry into London within two years of Edward's death.

Thus began much trade between Russia and England. Queen Elizabeth always wished to be on good terms with Russia, though she declined to marry Ivan. He could not understand her position towards her subjects, telling her that it was they who governed her, so limited was her authority. He considered that the lives of his people were his own property, and he put them to death whenever he pleased. When he died the empire was not only greatly enlarged, but it was in a better state of defence than it had ever been.

THE TYRANT RULER WHO ENSLAVED A WHOLE NATION

It was left to the reign of Boris, a powerful noble of Tartar descent, to complete the enslavement of the Russian peasants, which had been gradually growing for several reigns. In 1597 a decree was made, forbidding peasants, or serfs, as they were called, to leave the lands and estates on which they lived.

A miserable time of civil wars followed, chiefly on account of pretenders to the throne, and the country became a prey to its enemies. The Poles found their way to Moscow; in fact, there was a Polish czar for two years; and when they were driven out, the city suffered greatly. When differences arose with Sweden in Michael's reign, Gustavus Adolphus was able to carry a treaty through, which completely shut out the Russians from the Baltic. "We will hope," said Gustavus to his council, "that the Baltic will always prove too wide a jump for them."

An attempt to limit the power of the Crown was made when Michael, the first of the Romanoff line, was proclaimed Czar of all the Russias; and there were many difficulties with the Boyars, as the nobles were called, also with the Cossacks. The Cossacks were adventurous robbers who were of a mixed race, living in the south of Russia and Poland, the two chief tribes being those who lived on the Don and the Dnieper. They owed a nominal subjection to the Russians and to the Poles, and were organized into regiments, to serve as an advance guard to resist the Tartars and Turks. The Poles treated the Cossacks with great severity; and in the end they all owned Russia as chief over-lord, but they have always been very restless and difficult subjects.

THE BOY WHO BECAME CZAR AND GAVE HIS COUNTRY NEW LIFE

It was a Cossack who conquered a large part of Siberia, which was much visited by traders for its valuable furs, and presented it to Ivan the Terrible.

Towards the end of the seventeenth century, the direction of the affairs of Russia fell into the hands of a lad of seventeen. This was Peter the Great. He is said to have given new life to his country, so greatly did its fortunes change under his rule.

As a child he observed everything, and was fond of boats and engineering, and, as soon as he had a chance, he left Russia to travel, and learn all he could from other nations. The Czar of Russia to-day owns a little hut, at Zaandam, in Holland, where Peter lived when he worked in the dockyard, and gained a certificate of efficiency in various handicrafts, which is still preserved.

Then he went to England, and lived at Deptford. There are only a few remains left of the house in which he lived, and at which he did a great deal of damage to the locks and grass lawn and holly hedges; but the street leading to it is still called after the Czar Peter. William III., of England, ordered a sham sea-fight at Spithead to amuse his royal visitor. The fruit of Peter's labors in the dockyards was the foundation of a navy for Russia; and in time Peter gained entrance to a western sea on which to float it.

PETER THE GREAT AND HIS WARS WITH THE LAST OF THE VIKINGS

We have seen how anxious Ivan IV. was to reach the Baltic, and how Sweden managed to secure the lands that bordered it. Charles XII., who is sometimes called the last of the Vikings, gained, as we see on page 3656, some brilliant victories over Peter and the King of Poland, in defence of the

THE GREAT CZAR PETER, MAKER OF RUSSIA

When Peter the Great determined to travel in Europe, the Streltsi, a regiment of pampered and bigoted guards, conspired against him. Peter discovered the plot, and visited the conspirators unarmed, as seen here.

In this picture, we see Peter the Great, as a child, with his teacher. While he was quite young, the teacher was removed, and Peter wasted all his time at play.

Peter the Great was fond of the sea, and had almost a mania for ship-building. Here we see him standing in a small boat upon the sea in a fierce tempest.

Peter went to England and lived for a time at Deptford, where he dressed as a workman and studied ship-building in all its branches. During his stay on the Thames, King William III. visited Peter, as shown here.

disputed territory; but at last Peter gained control of the river Neva, that flows into the Baltic by the Gulf of Finland. Peter renamed the place at its mouth, which had once belonged to Novgorod the Great, Schlüsselburg, from the German *Schlüssel*, a key; he also gave a German name to the fort, Kronstadt; and to the new capital, St. Petersburg, that he created to help to Russianize the long-desired Baltic.

THE NEW CAPITAL OF A GREAT EMPIRE THAT IS BUILT UPON A SWAMP

He lost no time in starting the foundations of his new city. It had to be built on piles, the site consisting of swampy islands on the Neva. Thousands of workmen were brought from their homes to build churches and fortresses, palaces and houses, of every kind.

But Peter was not only a builder; he was a reformer. He made new regulations for the government of the Church, altered the customs of society, forbade all Eastern habits brought in by the Tartars, insisted on people shaving, and did all in his power to make Russia like Western Europe. He built canals, had books translated, founded libraries and museums, and traveled with unflagging energy all over his dominions. We shall find many traces of his visits when we read the story of Russia of to-day.

Peter's ambitions were not confined to the western sea. He took a most important step when he seized Baku, on the Caspian Sea, for here are the wonderful oil-wells that to-day bring much wealth into Russia; also the Caspian Sea has proved very useful as a thoroughfare.

HOW WOMEN RULED RUSSIA AFTER THE DEATH OF PETER THE GREAT

There were sad sides to Peter's life and character, but one likes to remember how much good he did, how simple were his tastes, and to think of him sitting in an old coat, smoking, with some newly arrived Dutch or English skipper, hearing the latest news in ship-building and trade. This greatly horrified his nobles. Peter's reforms were stopped for a time after his death, and there was much misery in the country from factions, palace revolutions, assassinations, and banishments to far-distant Siberia. It has been called the time of the rule of women. Catherine I., Peter's widow, a peasant who could neither read nor write, succeeded him, and in her short reign Behring, a Dane, was sent to explore Kamchatka. His name was given to the straits, some forty miles wide, that separate Asia from America. When Peter's niece, Anne, came to the throne, another attempt was made to lessen the power of the Crown, and give some measure of self-government to the people, but it failed; and during Anne's reign there was much tyranny by adventurers and others, who succeeded in making her do as they wished.

After her came Elizabeth, the daughter of Peter the Great. In her reign Russia gained the south part of Finland. This country had been converted to Christianity by two Englishmen, St. Henry and St. Thomas, in the twelfth and thirteenth centuries.

THE RETURN OF THE EXILES FROM SIBERIA AFTER THIRTY YEARS

For a long time, Finland was a Swedish province, and sent representatives to the Swedish Diet. Many towns rose up over the picturesque country, and the Finlanders advanced steadily in civilization, in spite of many attacks. They have enjoyed considerable liberty, and have developed a most sterling and charming national character.

In Elizabeth's time, Russia joined in the European war against Frederick the Great, whose fortunes were at their lowest ebb when the empress died, and her successor, who was an ardent admirer of the Prussian king, and his nephew, made peace with him, and renounced the conquest that had been made. This was Peter III. A strange sight it must have been at his court, when he recalled from Siberia the exiles who had been banished long years before in the various palace quarrels and revolutions of preceding reigns. Some of them had been exiled for thirty years.

Peter was followed by his wife, Catherine II., generally called the Great. Hers was a long and eventful reign, as full of interest as that of Peter the Great. She made many enemies by taking away the lands and peasants belonging to the Church to be the property of the State. The Church had become enormously rich, and there were great numbers of monasteries and clergy in all parts of the country.

Poland at this time was breaking up, and Russia had seized a large part of this

THE COSSACKS IN THE OLDEN DAYS

The subjection of the peasant classes to the nobles lasted longer in Russia than in any European country. Here we see peasants bringing bread and salt to their feudal lords, 200 years ago, in token of subjection.

The Cossacks maintained a measure of freedom and independence in Southern Russia for centuries. Here they are sending a fierce reply to Sultan Mohammed IV., who claimed sovereignty over them about 1670.

The bitter oppression in Catherine the Great's reign, led to an insurrection in Eastern Russia, in which a Cossack, named Pugatchev, shown here, became leader, and pretended to be the dead czar, Peter III.

kingdom. Important as this was, still more advance in the development of the country was made when, at last, after many attempts, Russia reached the Black Sea.

A war with the Turks led to the independence of the Crimea, and Azov was ceded to the Russians. Later, the Crimea was annexed. Catherine made a journey to this new part of her dominions, where she met the Emperor Joseph II., son of Maria Theresa, at Kherson, near the mouth of the Dnieper.

There were not wanting grievous troubles, too, in this reign; among them a terrible plague in Moscow and insurrection among the Don Cossacks. When Catherine died, the long-desired province of Kurland, on the Baltic, had been added, besides the shore on the Black Sea about the Dniester; Odessa, destined, as we shall see, to become a great port for sending away grain, was founded; also the important fort of Sevastopol was built. Among the famous generals of Catherine's day was Suvaroff, who distinguished himself in the wars against Frederick the Great of Prussia, against Poland, against the Turks, and, in the reign of her son Paul, in the wars of the French Republic.

Just before Paul's death the ancient kingdom of Georgia, between the Black and Caspian Seas, south of the beautiful Caucasus Mountains, was surrendered to Russia by its last prince. This interesting country had a very ancient Christianity, and long lines of native kings. Its capital was Tiflis. It was open to constant attacks by the Persians and others, and there were many factions within the country itself. In the reign of Paul's son, Alexander I., another great accession to Russian territory was the rest of Finland, surrendered by Sweden.

But Alexander's chief work was the mighty duel with Napoleon. Thousands of Russians had to march hither and thither over the face of Europe, to try to cope with the conqueror. Twenty-one thousand Russians lay dead at Austerlitz. There was none present at Jena; for it was soon after that battle that Napoleon and the Czar of Russia met on a raft in the river Niemen and agreed to divide Europe between them. But Alexander's subjects were ill-satisfied, for a quarrel with England meant much loss of trade. Later, Alexander did not keep to the arrangement he had made with Napoleon, and ventured to neglect his directions against English trade.

HOW THE RUSSIANS BURNED THEIR CAPITAL IN ITS HOUR OF DOOM

This angered Napoleon greatly, and we read elsewhere of the gathering of the Grand Army and its march across Europe to punish Russia. With stubborn courage, the Russians fell back, and yet farther back, till, at last, the French hosts were in sight of Moscow. The Russians determined to sacrifice their splendid and sacred city, and to let the French enter without striking a blow. So the troops and inhabitants retired, removing, in haste, valuables of every kind. When the invading army first saw the brilliant domes of the city, especially of the Kremlin quarter, where fortresses, palaces, and cathedral form a grand sight, loud shouts of triumph, "Moscow! Moscow!" burst from them. They were astonished to find it empty; and no sooner were they settled in the city than fires burst out. In six days, nine-tenths of it were destroyed. Napoleon waited five weeks in the smoking ruins, hoping that Alexander would treat for peace; but he made no sign, and the French had to retire, beaten by the terrible foes of cold and starvation.

In the reign of Nicholas, renewed efforts to obtain a constitution were made, and, in a war with Persia, two provinces were gained that became steps on the way to Central Asia.

HOW POLAND FOUGHT FOR FREEDOM AND LOST ITS NATIONAL LIFE

As we read in the story of the Balkan Peninsula, told on another page, all through the nineteenth century struggles for freedom from Mohammedan masters often involved interference by Russia, as head of the Greek Church, to which most of the Balkan countries belong. This interference caused many wars. The Poles made brave efforts for freedom, that finally resulted in the loss of the constitution which had been granted; many other rights were taken away, and Poland was declared a Russian province in 1864.

France and England declared war against Russia in 1854, because they were afraid, if the Turks were driven out of Europe, Russia would seize Constantinople, and become too powerful. So the

Allies invaded the Crimea, bombarded Odessa, and also sent a fleet to the Baltic. There are a few people who still remember the excitement, as news of the war reached England. The passage of the Alma, the siege of Sevastopol, the battle of Inkerman, followed in succession. The brilliant charge of the Light Cavalry at Balaclava is described in Tennyson's poem on page 1798.

"It is magnificent," said a French onlooker, "but it is not war!"

THE SETTING FREE OF THE SERFS AND THE KILLING OF THEIR LIBERATOR

Much indignation was felt in England at the mismanagement of the war, and the needless sufferings of the soldiers for want of proper clothing and food, and delirious joy reigned at the proclamation of peace. Miss Florence Nightingale's hospital for the sick soldiers was at Scutari, opposite Constantinople, and the remains of many British soldiers rest there, under the dark cypress-trees.

The Czar Nicholas died before the war ended, and was succeeded by his son Alexander II., who was the most liberal-minded ruler that Russia had yet had. In the early part of his reign he took steps to free the serfs. Although he had the support of all the enlightened people of Russia, even among the nobles, he had to face a good deal of opposition. He persevered, however, and in 1861 issued a decree which emancipated all serfs in the empire. From that he went on to other reforms. Great improvements were made in the laws. The courts were reformed. The country districts were given a measure of self-government, railways were built and trade and commerce encouraged. But Alexander did not do as much as many of the people desired. Some of them, called Nihilists, came to the conclusion that the only way to get the reforms they wanted was to get rid of their rulers and overturn the government, and in 1881 the emperor was assassinated by the throwing of a bomb.

When Napoleon and his army caught their first view of Moscow, they were enraptured with the glories of its gilded domes lighted up by the brilliant sun. But their joy was short-lived. The Russians had fired their city in many places, and the ancient capital of the Muscovites was reduced to ruins. Here we see Napoleon riding through the burning streets, with an escort, after paying a visit to the palace of Peter the Great.

It was in the reign of Alexander II. that, as a result of various risings against the Turkish rule, and the Russo-Turkish War of 1877, as we have read in the story commencing on page 3229, the Balkan countries obtained independence. In his reign too, Russia spread across Central Asia to within a few hundred miles of the Indian frontier, and, by a treaty with China, the left bank of the Amur was gained. The city of Vladivostock, Russia's great port on the Sea of Japan dates from this time also.

THE NEXT STORY OF COUNTRIES WILL BE ON PAGE 3797.

THE PEAKS OF THE CANADIAN ROCKIES

Here is a striking scene in the Canadian Rockies, showing in the foreground the thickly wooded slopes of the hills below the timber line, and the snow-capped mountain peaks in the distance. Far away upon one of the peaks is a glacier, similar to those famous glaciers of the Swiss Alps. In this photograph we have been very fortunate in being able to secure a view of the peaks clear-cut against the sky, for often heavy clouds close in about them and hide them for days at a time, as shown on page 3683. Seen from an aeroplane these peaks resemble a sea of mountains hundreds of miles wide. In the spring and summer open spaces in the forests blaze with exquisite flowers.

CANADIAN FORESTS AND THEIR WEALTH

CANADA is a land of forest. At its discovery, one dense continuous forest covered it from the Atlantic to Lake Winnipeg and north of the prairies to the Rocky Mountains, while the British Columbia forests stretched southward and westward to the Pacific. The early pioneers of Canada had to clear the land of trees before it was available for agriculture. All the settled parts of Ontario, Quebec and the Maritime Provinces have been hewn from the forests.

The sub-arctic forest is a continuous tract of woodland extending across the continent as far as the Rocky Mountains. Its northern limit starts in Labrador and passes near Churchill on the west coast of Hudson Bay and then in a northwest direction to the mouth of the Mackenzie River. To the northeast of this line is the country known as the Barren Lands. The sub-arctic forest belt varies in width from two hundred to three hundred miles.

Scrub pine, black and white spruce, tamarack and poplar are the characteristic trees and are the last to disappear on the barren grounds at the north. They are not dwarfed but retain their size and importance to the last, only withdrawing from the colder and wetter ground and occupying dryer and warmer places at the extreme northern limits. The scrub pine along the northern shore of Lake Superior increases in size as we go westward, and in Alberta attains a height of a hundred feet and a diameter of twenty-four inches. The poplar of small size in the East becomes in the West an important tree. The forests of the Peace River valley are composed of spruce and poplar. The latter touches the edge of the prairies, making the little bits of woodland on the western prairies. The balsam poplar and the white spruce are the important trees of the Mackenzie valley.

South of the sub-arctic forest appear the forests characteristic of the different provinces. British Columbia has a forest growth peculiarly its own. In the wet coast region the Douglas fir attains a height of three hundred feet and a diameter of from ten to twelve feet, and the western cedar grows even larger. Ninety-five per cent of the Rocky Mountain forest is made up of five species, Engelmann's and white spruce, black pine, Douglas and balsam fir. East of the mountains is the belt of poplar forest running from Edmonton to Winnipeg, a distance of nine hundred miles with a breadth of fifty miles.

In northern Ontario and Quebec, the characteristic trees are, maple, beech, birch, elm, ash, oak, hickory, pine, cedar, spruce and hemlock. The forest growth of southern Ontario is different and the predominant trees are the oak, hickory, chestnut, buttonwood and tulip. In the Maritime Provinces the

LUMBER LIFE, WEST AND EAST

This is a view of a typical logging camp at Vancouver, British Columbia, where nature has provided great wealth of resources as well as charm of beauty. Situated on an inlet and surrounded by forests, the location of the camp is a happy one for a variety of reasons.

The logs have formed a jam in this New Brunswick river. For a long distance, you can see, there is a heavy, solid mass from shore to shore. In such a case there is one log which is the "key" to the whole jam. Until it has been moved, the others cannot be freed. It is the perilous task of the experienced lumberman to extricate the "key-log," once it has been found. Pictures, British and Colonial Press.

ALOFT, TOPPING A SPAR TREE

Do you see the man at work high up in the tall, slender tree on the left, which has been stripped of branches? When the top is off and the trunk has been felled, it will make a long, straight spar.
Picture, British and Colonial Press.

same trees as in Quebec are found, but on the sea level of the Atlantic and the Bay of Fundy, the cooler climate brings back the spruce and firs. The maple, the national emblem of Canada, is widely distributed from the Atlantic to Manitoba in four species, striped, mountain, sugar and red. Two species, the broad-leaved and vine, are found in British Columbia. Only the characteristic trees have been noted, as in the Canadian forests more than a hundred varieties are found.

THE EXTENT OF CANADIAN FORESTS

Since the settlement of the French in Canada, vast areas have been cleared by man or destroyed by fire. Yet Canada is the third richest country in the world in wood resources and forest areas. The extent of Canadian forests is a matter of conjecture, as only a small per cent has been surveyed. A conservative estimate made by a prominent Canadian forester is 840,000 square miles, an area twice the size of France and Germany. To this must be added the sub-arctic belt, which would bring the area to over 1,500,000 square miles.

The increasing use of wood pulp for the manufacture of paper gives great importance to Canada's vast areas of spruce and poplar. In British Columbia hemlock is also used, and great increase in pulp-cutting is taking place in the province. For the manufacture of book and wrapping-papers poplar and jack-pine are also cut. It has been estimated that in New Brunswick, Quebec and Ontario there is only enough pulpwood to last about fifty years. But Europe is now calling upon Canada for wood pulp and every year the demand increases, as more and more paper is used.

The Maritime Provinces possess a large area of spruce. Pine is about exhausted but there is still considerable hardwood. Quebec has extensive forest areas, as thousands of miles of the finest timber have not been touched. The province possesses a considerable quantity of valuable white pine. In the north of Ontario there is a large tract of forests. The Georgian Bay district contains the largest area of white pine in the world and sufficient to supply the trade for a number of years. Ontario has a considerable amount of hardwood and an inestimable supply of spruce. In Manitoba, Alberta and Saskatchewan there is an abundant supply of poplar, pine, spruce, tamarack and some fir. Lumbering is an important industry in the two latter provinces.

British Columbia on the Pacific Coast has the largest area of salable timber in the world. The province has an area of 383,000 square miles and three-fourths of it is still covered with valuable timber. The lumber mills of the province could continue their cutting at the rate of three-fourths of a billion feet a year for twelve hundred years before the supply would be exhausted. A prominent lumberman has estimated the value of the standing timber at over nine billion dollars. Its great forests include yellow pine, Douglas fir, red cedar, hemlock, balsam and spruce, and many other beautiful trees. It is said that as much timber will grow in British Columbia in sixty years as a hundred years will produce in any other part of the Dominion.

NEED FOR PROTECTION

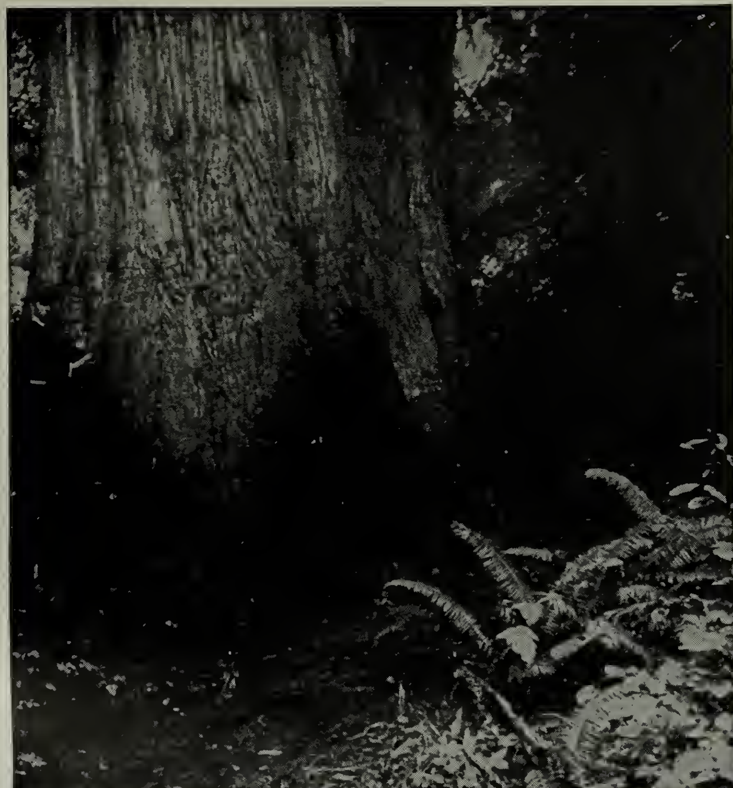
Canada's forest resources are immense but they have their limitations. Important as are the riches of Canada in lumber and forest products they cannot long be maintained without care in resisting both forest fires, which yearly sweep over large tracts of country, and the wilful waste by lumbermen. It must not be overlooked that the importance of forests does not consist merely in the immediate output of lumber, ties, timber and pulp wood, but in the regulation of water flow, prevention of soil waste and influence upon the climate.

The Dominion as well as many of the provinces has set aside large areas as forest reserves. It is to be hoped that this wise policy will be greatly extended. Foresters say that the selling of crown forest lands should be abolished, and that the license system, or the selling of the right to cut timber and pulp wood, should be universally adopted instead.

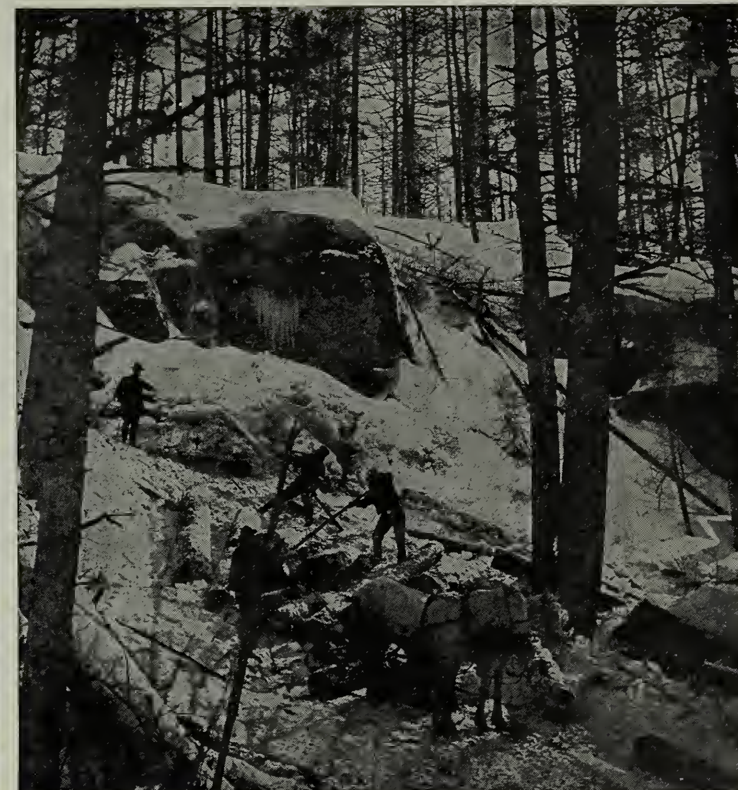
In Ontario and the prairie provinces, the provincial governments are doing much to encourage forestry. Tree nurseries are supported by the governments, and large numbers of young trees are distributed among people who desire to plant them.

The forests of the Dominion, though one of its chief assets, are not inexhaustible. Fortunately men have realized this, and are taking measures, by fire patrols and otherwise, to protect them.

SOME FOREST MONARCHS IN CANADA



This picture may help you to believe some of the stories you have heard about the trees of Canada. This is a cedar now standing in Vancouver, British Columbia. From the size of the man you can see how large the tree must be. Big trees are found in other places besides California. Douglas firs also grow to a large size.
Picture copyright by H. C. White Co.



Here we see men getting logs out of a forest in the Ottawa district. The trees after they are cut down are divided into standard lengths. The fact that the ground is frozen and the presence of snow enables a team to drag a weight which would be impossible under other conditions. The work is extremely dangerous.
Photograph by Notman.

HOW THE LOGS COME OUT OF THE WOODS

Every year trees which have been growing for scores of years fall under the axe of the woodsman. When they are cut down the branches are trimmed off, and the trunks are cut into convenient lengths. They are then loaded upon sleds and drawn to the nearest stream, or taken out as shown in the picture below.

When getting out lumber in a section where there is no stream of considerable size on which to float the logs to the mills, light railroads are often built into the woods. This method is much less picturesque than the "log-drive" down the river, but is also less dangerous for the men who are employed at the work. The railroads are usually very roughly built and the bridges, as the picture shows, are temporary affairs. Photographs from Brown Bros.

MONARCHS OF THE PRIMEVAL FOREST

The forests of British Columbia are immense in size, and form one of the chief sources of the wealth of the province. Vegetation grows rapidly in British Columbia, but it takes giants such as these many years to reach their full size. The government is already taking steps to see that the forests are conserved.

LITTLE PICTURE-STORIES IN FRENCH

First line: French. Second line: English words. Third line: As we say it in English.

Il y avait une fois une petite fille qui avait une belle poupée.
It there had a time a little girl who had a beautiful doll.
Once upon a time there was a little girl who had a beautiful doll.
Cette petite fille avait un frère et ils jouaient ensemble toute la journée.
This little girl had a brother, and they played together all the day.
This little girl had a brother, and they used to play together all day.
Un jour ils querellèrent. "Je casserai votre poupée," s'écria le garçon.
One day they quarrelled. "I will break your doll," himself cried the boy.
One day they quarrelled. "I will break your doll!" cried the boy.



La petite fille fondit en larmes, et elle berça la poupée dans ses bras.
The little girl burst in tears, and she rocked the doll in her arms.
The little girl burst into tears, and rocked the doll in her arms.
"Si vous blessez ma poupée je ne vous parlerai plus jamais," dit-elle.
"If you hurt my doll I (not) to you will speak more never," said she.
"If you hurt my doll I will never speak to you again," said she.
Le matin la petite fille courut à la chambre des enfants.
The morning the little girl ran to the room of children.
In the morning the little girl ran to the nursery.
Elle alla au berceau, mais il était vide. La poupée était partie!
She went to the cradle, but it was empty. The doll was departed!
She went to the cradle, but it was empty. The doll was gone!



"Ce mauvais garçon l'a prise," s'écria-t-elle frappant du pied.
"That bad boy it has taken," herself cried she, stamping of the foot.
"That bad boy has taken it," she cried, stamping her foot.
A ce moment le chien bondit dans la chambre portant la poupée.
At that moment the dog bounded into the room carrying the doll.
Just then the dog bounded into the room carrying the doll.
"Le méchant!" s'écria la petite fille. "Je suis fachée que j'étais en colère."
"The naughty!" herself cried the little girl. "I am sorry that I was in anger."
"Bad dog!" cried the little girl. "I am sorry that I was angry."

JOHN MAYNARD, PILOT

CONTINUED FROM 3695

IN thick darkness the great steamer was creeping through dangerous but smooth waters toward the end of her journey. The passengers and most of the crew were asleep in their berths. The captain was taking his well-earned rest in his cabin. On the bridge was the pilot, a man named John Maynard, who had left his wife and the son whom he loved much better than his own life, to bring this great ship safely into harbor.

It was one of those dark nights at sea when it is impossible to catch a glimpse of the vast ocean through which ships make their way. Not a star shone in the sky. The little discs of light made by the portholes perished in the wall of darkness enclosing the ship. The only sounds in the darkness were the grinding of the paddles, and the deep, low murmur of the smooth sea.

So smooth, so gentle was the ocean, that none could dream of disaster. It was a fitting night for the end of a dangerous voyage, for the peace and rejoicing of a home-coming.

But, of a sudden, a terrible cry arose above the sea—a cry of "Fire!"

Gone now was the darkness. Every face was visible. Every line of terror could be seen in that frightful glare. And another sound was added to the moan of the sea and the noise of the paddles—the rushing, roaring, hissing sound of fire that leaped in a writhing cloud of sparks to the sky.

The captain cried out in a loud voice: "Listen! In ten minutes more we may reach land. Our lives may yet be saved. It rests with the pilot. If he can hold on at his post we shall reach the land." He turned around, and called: "John Maynard, are you there?"

A quick answer came from the bridge: "Ay, ay, sir!"

In an instant, despair was turned into hope. That answer was so strong, so sure, and it had come so quickly. Only ten minutes. They were saved! John Maynard could see laughing women kissing their babies, and fathers smiling into the eyes of their sons.

The great ship, now a driving shape of flame, cut through the smooth and dangerous water at its highest speed, a race against fire!

Would they reach the land in time? With every turn of the paddles they were nearer to safety; but with every *second* the flames increased in fierceness.

What of the pilot? Was he still safe at the wheel?

"Are you there, my lad?" cried the captain.

There was no answer.

The passengers felt their hearts sink, and a new terror possessed them.

But, just as they abandoned hope, the answer came—so slow, so choked, so difficult, that it was hard to believe that the same man spoke.

"Sir, I'll try," said John Maynard.

The thoughts of the passengers, at that instant, were turned from the faithful pilot. The lights on land suddenly stood out before them in the distance. A loud cheer ascended from the decks. They were saved. The race against fire had been won. Land was near; houses were visible; the towers of churches, the names of shops, and the lamps in the street came into view. Boats could be seen putting out to them.

John Maynard, from the bridge, could see mothers clutching their children to their hearts. His own little son, his well-beloved, was asleep at home, far away. The moving mass of roaring flame, which once had been a ship, reached the harbor.

Passengers threw themselves into the waiting boats. Not a thought was given to the pilot. On the sides of the harbor was gathered a dense multitude, watching the spectacle of a great ship on fire.

When everyone was saved, the boiler exploded with a deafening roar, and John Maynard was hurled into eternity.

Many men who stood on that flaming deck remembered to their dying day, as the most vivid impression of their life, the look on John Maynard's face as he held to his post in the blinding smoke and the fiercely raging fire.

A POACHER'S SILENCE

Many years ago a gamekeeper was killed in the East of England, and two poachers were arrested for the crime and brought to trial. There was no difficulty as to which of the prisoners was the guilty person. One of the men confessed that he and he alone had done the horrible deed. But for some reason or another there was a general feeling that he was innocent, and the trial excited very great interest. When the verdict was given, and the judge had pronounced sentence of death, the friends of the prisoner bestirred themselves, and, raising the plea that he suffered from a deformity of the neck which would make it a torture to hang him, they succeeded in getting a respite.

But, after the respite had been granted, the law ordered a medical examination of the prisoner, and none of the doctors could find any reason why he should not meet the punishment for his crime. He was, therefore, for the second time condemned to death. But his friends were utterly unconvinced that he was guilty, and immediately set about getting up fresh petitions for his reprieve. So numerous and so earnest were these petitions that the law again granted a respite, and the poacher was sentenced to penal servitude for life.

Think what those words mean—"penal servitude for life." They mean that a man ceases to be a man, and becomes a number; that every to morrow is the same soul-killing monotony as yesterday; that no friend may come near him; and that the life of the world is shut out from him by frowning walls.

Perhaps this poacher many times wished that the law had put him to death, for he lay in prison day after day, week after week, month after month, for nearly thirty years. Then he was released. He went into prison a strong and vigorous man, with dark hair, bright eyes, and ruddy skin; he came out white and bowed, and marked for ever with the grey pallor of the prison cell.

And when he came out and found that his fellow-poacher was dead, he told the story of his crime. It was not he, but his fellow-poacher, who had killed the keeper—struck him down with the butt of the gun, and thrown the body into a pond. He himself had had no hand in the crime. But why did he take upon himself the guilt? Why did he twice hear himself condemned to be hanged, and then for nearly thirty years of awful torture hold his peace? The answer shows us that even in bad men there is a soul of goodness. This rough English poacher held his peace because the real murderer was a married man with a wife and children dependent upon him for support. He himself was unmarried. And so, for the other man's wife and children, this simple, rough-hearted poacher did what he could, and offered his life.

THE NEXT GOLDEN DEEDS ARE ON PAGE 3823.

A THIRD TALK ABOUT TREES

A TREE AND THE WORLD'S LIFE

CONTINUED FROM 3670

MOST people know that trees are beautiful things. A great many people know that they are useful things. But few people, perhaps, realize that trees are absolutely essential to existence. History, indeed, is an arm-in-arm march of Man and Forest. Not only would man never have been able to advance from savagery without trees, but without trees he could have not even been a savage. He could not have been at all.

Have we ever realized that in some senses the tree is the father of humanity?

Directly we begin to think, a hundred things jump into our minds which show us the immense importance of trees. The great express trains that rush across the country, and carry us from place to place owe their origin to the kindly woods. They are now built of steel; but until the destruction of the forests caused it to become scarce all railway cars were made of wood. Even now, many noble trees are sacrificed to provide these beautiful fittings which add so much to our comfort. The pity is that so few trees are planted to take their place.

Not only this, the iron and steel which make such a pompous clatter, could not have taken their part in the advance of humanity without fire, and without trees there could be no fire. The steam shrieking from the whistle, the smoke drifting from the funnel, the sparks whirling up into the air, were once trees. Every spark was once lodged in a tree, every gas was once buried in a tree, every lump of coal was once hidden in a tree. The death of the forest is the birth of the coal field, and out of the coalfield leaps the genie called Progress, man's helper and salvation, in her robe of fire.

Let us turn away from the train, and wherever we look we shall see the same energy and activity of the forest. Our houses are cut, like saplings, from the forest. When we throw up our window we lift a branch, when we open our door we move a tree. We cross the room, we are trampling the forest. We sit, the forest supports us. We write, it is still the forest that serves us. It is cold; we will have a fire; the forest lights it. We are hungry; let us eat; the forest cooks our meal.

There is not a traffic of the human race, not an art, not a science, not a comfort, and not a beauty which does not issue from the heart of a

tree. Strange, too, is it that the centuries of man's existence are divided by a tree, on one side the centuries before, and on the other the centuries after, the Cross of Christ. If we cross the desert of Sahara we find ourselves ploughing through an ocean of sand. Nothing will grow there. It is a dead land, profitless, empty, appalling. Now, the whole earth would be one hideous Sahara but for trees. And Sahara would not be a desert if it were covered by greenwood. The earth is what it is according to the presence or the absence of trees.

THE FORESTS THAT FORM AN UMBRELLA TO SHADE THE EARTH FROM THE SUN

Forests present to the sun an immense umbrella. They shield the soil from rays which would otherwise burn up into smoke-like dust the rich pastures of the earth's surface. Herbage, which grows under the shelter of this immense umbrella, is itself a form of sunshade, as it were, a doll's sunshade; it seeks to imitate the mighty forest by protecting the soil from the scorching rays of the sun. Without trees the richest soil would soon perish and become merely a desert of sand.

For not only do forests intercept the scorching rays of the sun, driving them back from the earth, they also preserve the springs at their roots from the thirsty greed of those rays.

All the countries along the lovely Mediterranean Sea—Turkey, Italy, Spain and France, though still beautiful in their coloring, and so pleasant in winter that people flock to them from all parts of the world, are, nevertheless, the ruin of what they once were.

Once upon a time these lands were fertile to an unusual degree, with plenty of springs to give them water for man and beast, and to give life to their crops. But the axe was laid to the root of the tree; the mighty forests covering those splendid mountains, and looking so useless and idle, were cut down.

HOW THE CUTTING DOWN OF THE TREES HAS DRIED UP THE EARTH

The result soon showed itself. The land grew sulky. The springs dried. Only in certain places was it possible for man to scrape together a living. We may now walk for a whole day along the Riviera without seeing a single bird. Far worse than the case of the countries bordering the Mediterranean is the case presented by the condition of British India. When we read of a terrible famine ravaging that mighty continent like a wolf, sweeping away the inhabitants as if they were so many flies, we should remind ourselves that man's foolish interference with nature is the cause of this appalling havoc.

Once the mountain slopes of India were covered by magnificent forests; they were cut down and sold for money. The people did not realize that God makes a thing useful as well as beautiful. The beautiful trees, hewn down as a revolution hews down the gilded idlers of society, were in reality the most useful servants of India. It was those idle-looking trees which, in the blessed season of rain, drank up at a million million mouths the precious drops of moisture, and stored them up for that dread of India—the sunny day. Now, when the rain falls, there are few forests left existing to catch it; the drops strike the earth, sink in, or slide to the rivers, and away they go to sea—precious water running away from a parched and arid land. The great forest was India's water-tap.

THE ENORMOUS VALUE OF TREES TO THE EARTH AND TO MAN

Trees, then, we see, not only do service to the soil, and not only preserve for our use the springs of water, but they also affect climate. The climates of countries are very largely influenced by the presence or absence of trees. Humboldt, the man of science, has summed up the service rendered by forests under three heads: (1) They screen the soil from the heat of the sun's rays; (2) their leaves offer an immense surface to the cooling process of radiation; (3) their leaves give off an incalculable evaporation of moisture.

From trees we get coal and materials for buildings; we get also valuable drugs, gums, dyes, and articles of food. But, above all these things, it is important to remember that trees influence the air and the soil of the country; that they oppose their quiet strength to the great enemies of our race—extreme heat and extreme cold; and that they have an all-important bearing on the hidden springs of the earth.

We should cultivate in ourselves a love for trees, and look upon them with something more than mere admiration.

THE WALNUT, "THE FOOD OF THE GODS"

These long graceful catkins are the male flowers of the walnut. The female flowers are small and insignificant. Three of them are seen on the lower shoot.

The leaf of the walnut is divided into spear-like leaflets. In Germany, no young farmer used to be allowed to marry until he had planted some walnut-trees.

The tree which bears the walnut of commerce, called the Persian walnut, French walnut, or English walnut, came to us, as we can tell by its names, from the East through Europe. It grows freely in California, especially if it is grafted on the native Californian species. Its wood has a fine grain and is much used for furniture.

THE CHESTNUT, THE FOOD OF THE POOR

The handsome, glossy leaves of the Spanish chestnut, which are nine or ten inches long, change in autumn from a rich green to golden yellow, and then to brown, and when they fall they improve the soil. The yellow flowers are small, but appear striking as they grow together. Their strong odor is offensive to many people.

The Spanish chestnut, which is also called the sweet chestnut, is the tree from which we get the well-known nuts for roasting. In some parts of Italy poor people eat chestnuts instead of bread. Chestnut-trees grow to a great age. They are closely related to the North American chestnuts, among which is the chinquapin

THE HORSE-CHESTNUT'S SILVER FLOWERS

There is no finer sight presented by Nature than a horse-chestnut tree when it is in full bloom. The leaf of this tree is split up into leaflets, and these are so large that many people think that each separate leaflet is really a complete leaf. The tree has been endeared to American children by the poet Longfellow.

The fruit of the horse-chestnut looks so like that of the sweet chestnut that many people think it is a variety of that tree. But, as a matter of fact, the two trees belong to distinct families, and, from a scientific point of view, the fruits are not at all alike. Here we see a horse-chestnut "in all the richness of its heavy velvet drapery, embroidered over with millions of silver flowers," as a writer has picturesquely described it.

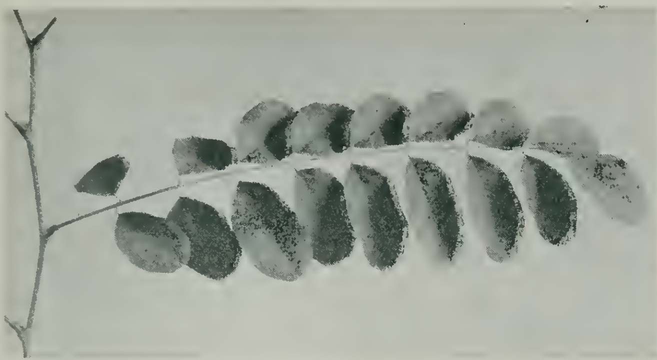
THE LABURNUM'S GOLDEN EAR-RINGS

There is no prettier sight than the laburnum with its clusters of yellow flowers, like golden ear-rings.

Leaves and flowers appear in May, and the leaflets form in threes at the end of long, slender stalks.

The laburnum grows about thirty feet high, but does not throw out very long branches. The tree is a native of Europe, but will grow in this country. Its branches and leaves are poisonous to cattle.

THE LOCUST-TREE'S SILVER CHAINS



The locust-tree is also called the false acacia, because at one time it was thought to be an acacia. The leaf looks like a feather, and the delicate flowers are white. A locust-tree in spring time is a dream of beauty.

The locust-tree was one of the first American trees to be taken to Europe. The wood is hard, and valuable for fence-posts, ship-building, cog-wheels, and for furniture as it takes a beautiful polish. Policemen's clubs are made from it. The tree grows rapidly, but is often attacked by insects. It reaches the height of 75 feet.

THE GREEN PYRAMID OF THE MOUNTAINS

The "rosy plumelets" of the larch, as Tennyson calls the flowers, vary in color from pink to purple, though they are usually reddish-purple. The leaves grow in tufts; but, unlike other trees that bear cones, the larch loses its leaves in winter.

The larch is the tree of the mountains, and in the Alps forests of larch grow 6,000 feet above the [illegible] The European larch, shown here, is grown in this country. The tamarack is our best-known n[illegible] to cattle. The tree becomes a fine green pyramid a hundred feet high, and the wood is used for tel[illegible]

THE CHILDREN'S CHRISTMAS TREE

We can see something familiar in this branch of spruce fir, for Christmas-trees are trees of this kind. Spruce means "sprout."

The fruit grows on the previous year's shoots, and ripens after twelve months.

A great deal of the paper used to-day is made from wood, ground into pulp, and forests of spruce fir are grown for this purpose. It is a tall, graceful tree, and is one of the oldest of forest trees, for remains of it have [illegible] among the fossils. There are several species of spruce and some of them grow to a great height.

The photographs on these pages are by Henry Irving.

THE CEDAR, "THE GLORY OF LEBANON"

The needle-like leaves of the cedar grow in tufts like those of the larch, and remain upon the tree four or five years. These leaves are about an inch in length.

The flowers grow at the ends of short branchlets, and the brown cones that result are shaped like a plum. They remain on the tree for several years.

All kinds of superstitions have grown up round the cedar, "the glory of Lebanon," as Isaiah calls it. One is that the Cross was made of cedar wood, but there is no evidence of this. The name cedar means "power," and refers to the strength of the wood. The tree which in this country is known as "cedar" is a juniper.

THE NEXT PICTURES OF FAMILIAR THINGS ARE ON PAGE 3811.

Camp Fire Girls Begin the Day by Saluting the Flag.

THE CAMP FIRE GIRLS

CONTINUED FROM 3629

THE organization called the Camp Fire Girls was started in the spring of 1911. It consists of groups of girls over twelve years old, and aims to show that beauty, romance and adventure can be found in wholesome ways. The Boy Scouts have their training in manliness and in citizenship, and the Camp Fire Girls their lessons in womanliness and homecraft. Local Camp Fires consist of not less than six, and not more than twenty members, in charge of a woman who is a natural leader in her community, and who is called "The Guardian of the Fire."

As soon as the group is formed, and the Guardian has received a certificate for herself and charter for the group from Camp Fire Headquarters, they begin to work for their honors. In addition to daily activities the girls have weekly meetings, and a Council Fire once a month for the awarding of honors and conferring of ranks. In the various groups the girls learn to work and to play together in harmony. They learn to cook, to market, to take care of their rooms, to swim a hundred yards, to know the planets and their stories. Some girls trim hats, others take photographs, developing and printing them, while others prefer to design a basket, or to make a dress.

Camp Fire is a great educational system which emphasizes the doing of things, as well as the "knowing how to do." It educates through the process of "approval." Recognition is given for attainment; and failures are not recorded.

THE HONOR SYSTEM OF CAMP LIFE

The four hundred required and elective honors form "measurable bundles" or "steps" in attaining the different ideals or ranks. When a girl lays aside her everyday clothing, and puts on the same Camp Fire uniform which every other Camp Fire Girl wears, she is by that act placing herself on a level of absolute equality where only the girl herself counts. Her character and what she is able to do for the common good alone gives her rank.

Nothing will more quickly help a girl to find herself and her true relation to others, her strength, and her weaknesses, than camping under this most democratic system of life together in the great outdoors. If she has courage and unselfishness, these qualities appear at once and are quickly developed; if she is lazy and inclined to shirk her share in the team work, this

is soon corrected. The girl who has lived a sheltered life learns the joy of cooking, swimming, paddling, tramping, making her own bed, carrying her own blanket and taking care of herself in the open; but what is most important, she learns the valuable lesson of helpfulness to others, and often establishes her health permanently.

The Camp Fire organization is close to the home and social life. A Camp Fire should consist of girls of about the same age, who naturally belong together, whose homes are in the same neighborhood, and who like one another. The best results are secured when the Guardian and the group are socially congenial. The philosophy of Camp Fire teaches that the knowledge of life which may be gained in the home, on camping trips, from nature lore, and campcraft, is as important a part of the girl's education as the knowledge gained from text books and schools. "All life is a school."

This striking picture shows the first Council Fire of Camp Fire Girls in Sitka, Alaska. It was lighted on an old Indian battle-ground, and the picturesque surroundings form an appropriate setting for this ceremony.

CAMP FIRE BLUE BIRDS, THE JUNIOR ORGANIZATION

The Blue Birds is an organization for younger girls, six years old and over. Each group, presided over by a Camp Fire Guardian or Torchbearer, is known as a Bluebird Nest. The members, who are at first called "Nestlings," later become "Fledglings" and finally "Fliers." The Nestlings wear a downy gray dress, the Fledglings have a blue cap, and the older Fliers add blue wings to their costume. The expression Blue Bird means Happiness, and the little children sing because they are happy. Their motto is "Sing, Grow, Help." Each Blue Bird has her doll family; her little garden, perhaps only a window-box; and each little girl learns to play games,—hop-scotch, blind man's buff, croquet, fox and geese; and learns to sing familiar songs, like "Little Boy Blue," and "Little Birdie in the Tree." She also learns some folk dances, and studies the names of some of the flowers, and trees. When she is twelve years old, she may become a member of the Camp Fire Girls.

THE USE OF SYMBOLISM IN THE ORGANIZATION

To the Indians, fire stands for warmth, food, protection, and something more than that, for the mysterious voice of the Great Spirit. So to the Camp Fire Girl, fire as her symbol stands for the home, for simplicity and for genuineness. The symbolism of membership is the standing

THINGS CAMP FIRE GIRLS MUST KNOW

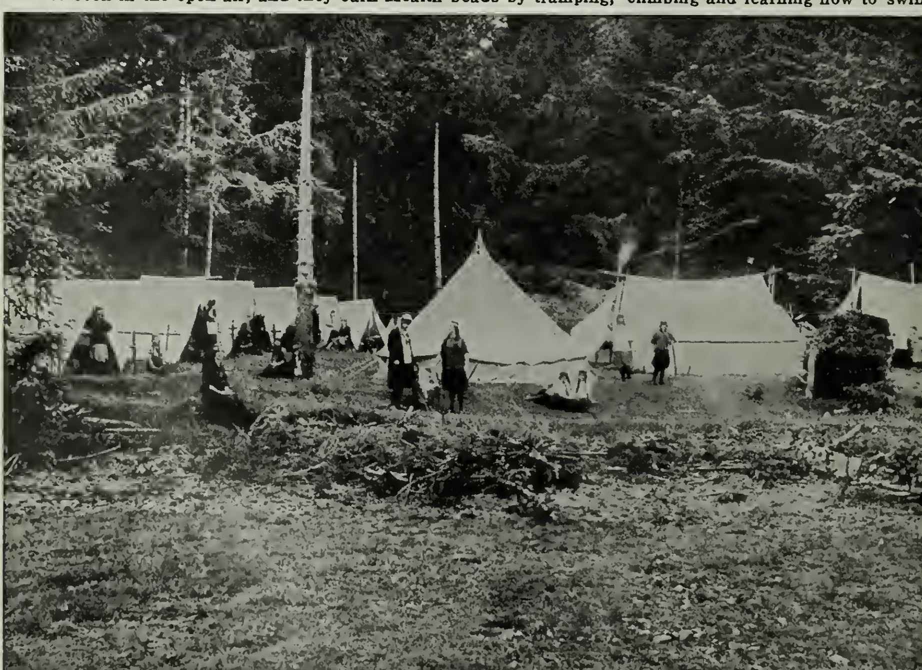
The picture shows Camp Fire Guardians at a national training camp learning how to put up a tent. Camp Fire Girls win Camp Craft honors when they can erect the tents themselves, and for sleeping five nights on the ground. They are expected to camp at least one week during the year and to live on schedule.

Here we see Camp Fire Guardians doing setting-up exercises. At seven in the morning they don their bathing suits and drill in the dewy grass. Then they plunge into the water for their morning bath.

Camp Fire directors showing at a national Camp Fire training camp how to roll a poncho. The girls must know how to prepare a poncho for an overnight hike, and many practical details of camp life.

AN EASTERN AND WESTERN CAMP

This is a picture of an attractive camp near the town of Mount Vernon, which is not far from the city of New York. The girls may win Camp Craft honors by keeping their tents in order. They must also learn how to cook in the open air, and they earn Health beads by tramping, climbing and learning how to swim.



The Camp Fire Girls first made it popular in Alaska for girls to go camping in those northern climes. They went to Sitka for their first wonderful camp. A fire was kept burning in the dining tent to enable them to keep warm and dry. All the girls had a splendid time in this camp, which was well located on the edge of the woods. Pictures by courtesy of the Camp Fire Girls of America.

HELPING TO CREATE THE FOOD SUPPLY

In this picture we see a group of young Camp Fire Girls caring for a garden. During war times the girls may earn Patriotic honors by keeping gardens. They sell, or preserve for winter use, the vegetables and other products which they raise Every particle of food raised in addition to the regular supply is a gain to the country in its hour of need, and an example to householders who own enough land to make a garden

This is a picture of a group of Camp Fire Girls in Pawling, New York, preparing some ground for gardens. These girls did all the work of their gardens and entirely supplied their summer camp with vegetables wbich they had grown themselves. They gained health, and at the same time were able to realize the happiness which comes from voluntary service, while they saved for others the food they would have eaten.

pine, meaning strength and simplicity. The salutation, the hand sign of fire, indicating crossed logs, is made by placing the fingers of the right hand over the fingers of the left, and slowly raising the hands in this position, indicating the curves of an imaginary flame.

The ceremonial gown has on it decorations showing the attainments, or the ideals and hopes of the owner. The gown is simple itself, and becomes interesting as the girl embroiders or stencils on her costume, her symbol, insignia and honors. The symbol is also worked in beads on her headband. Through the use of symbolic decoration, the everyday clothes which the girls wear, their bedrooms, and club rooms, are given added meaning. The symbols may tell a story of a camping trip or of close association with something in nature, such as a mountain, or a rain cloud, a tree or a bird.

THE CEREMONIAL OF THE COUNCIL FIRE

"Burn, fire, burn! Burn, fire, burn! Burn, flicker, flame!" so sings the Camp Fire Girl as she lights the candles. Although they look just like three ordinary candles, when lighted at a ceremonial meeting, they become symbolic candles—one standing for Work, one for Health, and one for Love. The Camp Fire Watchword is Wo-he-lo, formed by combining the first two letters from the words, work, health, and love.

Did you ever attend a Camp Fire Meeting? If you have never seen their Council Fire, close your eyes and try to picture the scene. The lights are turned low in the room, when the Guardian in costume enters and stands in her place in the circle about the fireplace. The girls in ceremonial dress and colored headbands come in silently, one by one, each one as she enters giving the sign of fire at the same time that the Guardian makes it. The Wood Gatherers, those who have fulfilled certain requirements, bring in the candles, and three Fire Makers, those who have won additional honors, light the candles. The Guardian hands the taper to one of the girls, who steps to the center of the circle and kneeling says: "I light the light for Work, for Wohelo means Work." She lights one candle, and then stands and repeats these words: "We glorify work, because through work we are free. We work to win, to conquer, to be masters."

The second Fire Maker comes forward and says: "I light the light of Health, for Wohelo means Health." After lighting the candle, she says: "We hold on to health, because through health we serve and are happy." The third girl advances and says: "I light the light of Love, for Wohelo means Love."

Through the lighting of the candles the girls give a spiritual meaning to the old ideas of work, health and love. The three ranks into which the girls are initiated are those of Wood Gatherer, Fire Maker, and Torchbearer. The Camp Fire Girl upon receiving the Wood Gatherer's ring gets a conception of loyalty and strength of purpose which is expressed in the bound fagots of the ring, and also the the idea of truth in herself as expressed in the Wood Gatherer's Desire which she repeats. The Fire Maker's Desire reveals the basis of all spiritual life. "The love of man for man, and the love of man for God." The work of the Torchbearer looks toward the future. She hands on life, strength and beauty of the present to future generations. After the candles are lit, the girls sing some of their songs, tell of their work, award new honors and play games.

CAMP FIRE GIRLS IN WAR TIME

Camp Fire Girls responded enthusiastically to the war programme of their Honorary President, Woodrow Wilson, with their slogan, "Work through the Homes." Thousands of girls started to walk one hundred miles a month to establish health and endurance. They contributed money generously, co-operated with the Red Cross and loyally supported Mr. Hoover by strictly fol'owing the rules for the saving of food and crops. Many of them gave up sweets and luxuries. The girls co-operated with the Agricultural Department by cultivating gardens, and in many other ways.

Since October of 1917, 10,000 Camp Fires have been chartered, and 100,000 American girls with their 6,000 Guardians of the Camp Fire, are a great and growing force for good. Such organizations as the Boy Scouts, about which you will read on page 6135 of our book, and the Camp Fire Girls may well prove powerful forces for establishing a better understanding and a more united spirit among the nations of the earth.

THE NEXT STORY OF THE UNITED STATES IS ON PAGE 3919.

Marking lines on the ice before beginning work, so that it may be cut evenly.

HOW WE GET OUR ICE

CONTINUED FROM 3650

HAVE you ever stopped to think what a difference in our comfort, and in our health, ice makes? In the ice-box the butter is hard, the milk sweet and cool, the lettuce crisp and tender, the dessert firm, and the meat for the next dinner does not spoil. Then, too, there are ice cream, soda water and lemonade, and perhaps some of you are allowed to have iced tea. When you go to market with your mother, you see the butcher bring out the meat from an ice-box as large as a room, perhaps, and you see the fish lying on ice. We take all this as a matter of course, without thinking about where the ice came from. Perhaps it is a part of the covering of the pond or river over which you skated last winter. Perhaps it was frozen last week in the building you can see on the hill, or else it was brought to your town in boats or railway cars.

NATURAL AND ARTIFICIAL ICE ARE BOTH USED

If you live in the country or in a little town in Canada or Northern United States, perhaps you have seen men cutting ice, and storing it in small ice-houses during the winter, for use during the summer; but the ice for a great city can seldom be gathered so easily, for there is not always a body of pure water near by large enough to furnish a sufficient quantity of ice.

So the city must bring its ice from a distance or else manufacture it, or perhaps both natural and artificial ice are used. Since New York uses more ice than any other city in the world, we shall show you the methods by which the millions of people who live there are supplied.

NOT ALL WATER MAKES ICE SAFE ENOUGH TO USE

There is no large body of pure water near the city, for the Hudson, when it passes by the city into the sea, has been soiled by the filth poured into it along its course. Further, it is salty, for the tides move up many, many miles. A third reason, and one quite as important as either of the others, is that the river is very seldom frozen in the lower part of its course.

In the upper part, however, where it is shallow and sometimes spreads out over the fields, it freezes, unless the winter is unusually mild, and the water is much purer than it is lower down. From these broad stretches, the greater part of the natural ice used in New York City comes. Hundred of men and horses, dozens of houses

and scores of boats are required to gather, store, and deliver this crop.

Now let us begin at the beginning. When the really cold days come, and the mercury drops far below the freezing point and remains there, the crop begins to form. One or two cold days are not enough, especially if they come suddenly, for the earth is warm and the water also. Then, too, the current has some effect in preventing ice from forming.

HOW THICK MUST THE ICE BE BEFORE CUTTING

Ice thick enough to allow skating with perfect safety may be entirely too thin to be cut and stored, for anything less than twelve inches thick cannot be stored profitably, and the icemen prefer to have it even thicker. Cold weather, continued for days, is required to produce ice twelve inches thick.

Let us suppose that the temperature has been low for several days or even weeks, and that ice thick enough for cutting has formed. Clear, cold weather without snow is preferred, for as you have learned in another part of our book, the snow forms a protecting blanket and hinders the freezing of the water beneath by preventing the heat of the water from escaping.

If snow has fallen upon the thick ice, it must be removed, and this is done by scrapers. Then follows the marker, which is shown at the beginning of this article. It cuts grooves in the ice about three feet apart, as the horse marches up and down the field. Then the horse and man turn and cut lines perpendicular to those already made, and the field takes the appearance of a great checkerboard with squares three feet on a side. Ploughs follow and cut the grooves deeper.

Some of these squares are then separated by means of saws and crowbars, and are either floated through a lane of open water to the ice-house or else they are loaded on sledges and drawn to the house. If you look at the picture, you will see an inclined scaffold reaching from the water's edge to a door near the top of the house. On this scaffolding runs an endless chain or belt with projections every few feet. The cakes of ice are slipped upon this, and as the belt moves are drawn up to the door and pushed inside. At the bottom of the page is a view of the interior of the house, which is solidly packed with ice, except for the sawdust which fills the crevices between the cakes. When the house is filled it is closed, and the men move on to another, for there are dozens of these houses along the banks.

Sawing the ice apart, after it has been marked into squares by the marker shown on another page.

HOW THE ICE COMES TO TOWN WHEN NEEDED

When this ice is needed in the city it is loaded in barges, as the clumsy boats which you see in the picture are called, and several of them are drawn by a tugboat down the river to the wharves where their precious cargo is loaded into wagons, and taken to a storage house

PACKING AWAY ICE FOR SUMMER DAYS

Men are floating the cakes of ice, each about three feet square, through the lane of open water to the foot of the inclined framework. Over this scaffold endless chains or belts are kept moving. Projections on these belts keep the cakes from slipping backward and they are carried to the top of the little tower, and then pushed off into the house, where other men pack them closely together. Notice the cakes on the belts.

Here is the interior of the house shown above. As the cakes of ice slide in they are packed closely together, so that the men you see are standing upon a floor made of blocks of ice. Other layers will be added until the house is full, after which it will be closed and the men will move to another house. When full, one of these houses is really an almost solid mass of ice enclosed by walls of wood and sawdust.

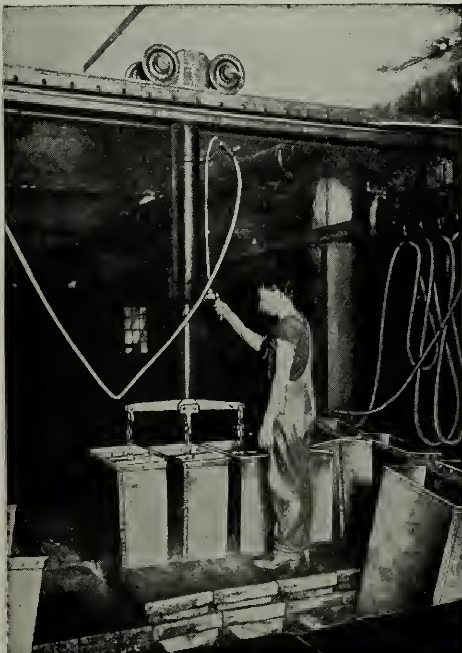
BRINGING ICE TO THE HOT CITY

As ice is needed in the city one of the houses is opened and its contents are loaded into clumsy barges, several of which are then towed down the river by a tugboat. The barge shown in the picture is lying beside the pier in the city, and is being unloaded into the wagons which you see on the pier above. A string of these barges drawn by a saucy little tug is an interesting sight, as they pass slowly down the river.

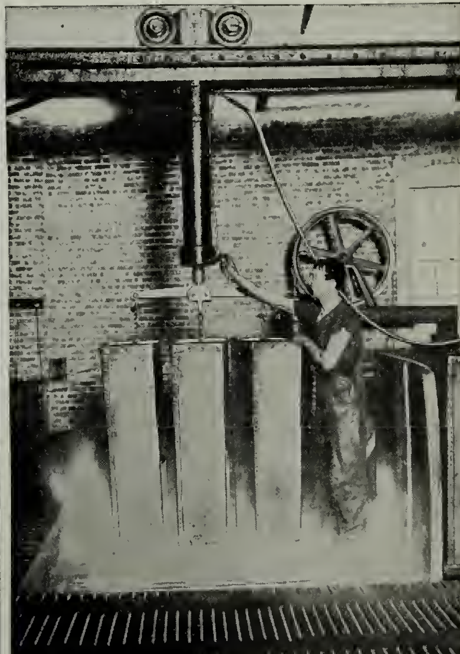
Here is the interior of the barge shown above. The work of unloading is almost completed. The ice tongs seize a cake of ice, which is then drawn up by the rope and pulley which you see in the upper picture. Within a few minutes the wagons will be filled and start upon their rounds to supply the regular customers. To each wagon is assigned a certain district, which it visits every day with its refreshing load.

HOW ARTIFICIAL ICE IS MADE

Here is the interior of an artificial ice plant. The floor is made, as you see, in sections, so that a part can be lifted without disturbing the rest, and underneath is a great tank of brine through which a network of pipes carrying ammonia runs. The man is filling the rectangular boxes, called "cans," with distilled water. When full, they are covered tightly and let down into the cold brine below the floor.



These cans have been in their briny bath for forty-eight hours, and their contents are frozen. By means of a crane worked by compressed air three cans at a time are drawn from the brine-tank below.



The ice, however, is frozen tight to the cans and refuses to come out. Therefore they are swung along the floor and lowered for a moment into a tank of hot water, and then the ice slips out easily.

OTHER VIEWS OF AN ICE PLANT

The glistening cakes, weighing about 300 pounds each, are then shoved through a trap-door into this room. Artificial ice is not frozen so solidly as natural ice, and the store-room must be artificially cooled. Natural ice freezes from the top, and the air bubbles are forced out. In the cans the cold is applied from all sides and the air bubbles go toward the centre, forming a milky streak which is sometimes not very well frozen.

Anhydrous ammonia may be a liquid or a gas, depending upon pressure and temperature. When forced into pipes as a liquid and allowed to expand it becomes a gas, but in so doing absorbs heat from the brine and reduces its temperature below 32 degrees. Afterward it is compressed and passes into pipes, over which you see cold water running. It again becomes a liquid, and may be used over and over again.

near the wharves, or is brought directly to your door by the heavy ice-wagon.

Most cities and towns which have cold winters use chiefly natural ice, but many of these have ice factories which furnish a part of the supply. In those climates where thick ice does not form in winter, the need must be supplied by bringing natural ice to them, which is expensive on account of the waste, or else ice must be made.

In the days before men learned how to make ice, large cargoes were often shipped to Southern ports, but the waste was so great that it was very expensive in Southern towns. Now ice is almost as cheap in the South as in more northern regions. Let us see how it is done. If you will read carefully you can understand, for it is really very simple.

THE MYSTERY OF MAKING ICE IN HOT WEATHER

You can learn in another volume of our book that when a substance changes from solid to liquid, or from liquid to gas, it absorbs much heat. If you have ever spilled alcohol on your hand or have had your mother bathe your aching forehead with camphor (which is simply solid camphor dissolved in alcohol) you will understand this. As the alcohol evaporates, that is, changes to gas, it takes the heat from your skin and makes it feel cooler. Ether will make it still cooler.

Now there are a number of substances which, while they are liquids under pressure, will change to gases at low temperatures if the pressure is removed. One of the cheapest of these is called anhydrous ammonia, which will boil, that is, change to a gas, at a very low temperature, if placed in an open vessel. Under heavy pressure it becomes a liquid, but struggles to resume its gaseous form.

Now here is the secret of ice-making. The ammonia is allowed to pass slowly into pipes, where it has room to expand into a gas. These pipes pass through a great tank of brine. In changing to a gas the ammonia absorbs the heat from the brine, and makes it very cold. The brine does not freeze, however, as you have learned that salt water does not freeze so easily as fresh water. But if cans of fresh water are placed in the brine, the heat will be taken from them, and, in about forty-eight hours, the water in a can 40 inches long, 22 inches wide, and 11 inches thick (which is a common size) will become a cake of solid ice weighing about 300 pounds.

HOW THE ICE-MACHINE WORKS DAY AND NIGHT

When the contents are solid, the cans are drawn out of the brine, and dipped into hot water for a few seconds, so that the ice will slip out easily when the cover is taken off. Then they are again filled with water and replaced in the brine to make more ice.

Another form of ice-machine freezes the ice in the form of slabs, or plates. Hollow metal boxes containing brine and ammonia pipes are set in a large tank of pure water. The ice freezes on the sides of the boxes. When it is thick enough, warm brine is pumped into the boxes, the plates of ice slip off into the water, and are taken out and sawed to the proper size.

MAKING THE AMMONIA DO ITS WORK OVER AGAIN

The ammonia gas, after it has passed through the pipes in the tank of brine, is again compressed, and becomes very hot in the process. If the compressed ammonia can be reduced to a temperature of 80° it will again become a liquid. So the pipes full of the compressed ammonia are arranged so that cool water runs over them, and the ammonia again becomes a liquid and this can be used again. So the process goes on day and night.

You have heard and read much of the danger of drinking impure water, but it is a common belief that water is purified in freezing. This is only half true. Much of the dirt in the water of a pond or river is forced out in the process of freezing, and some things which would cause disease, if drunk in water, are destroyed by freezing, but some of the most harmful germs seem to be able to live a long time in ice. Ice is always purer than the water from which it was made, but dangerous water makes dangerous ice.

In making artificial ice, the water is shut up in the can, and cannot force out impurities while freezing as natural ice does. So if it is made from bad water, it is more dangerous than natural ice made from the same water. Most artificial ice plants, however, use distilled water, and ice made from it is, of course, purer than any natural ice, if dirt is not allowed to get into the cans.

WHAT ARE COLD STORAGE WAREHOUSES?

You have heard of cold storage warehouses, and perhaps know that fruits, vegetables, meat, fish, eggs and other foods are kept in them sometimes for months. The plan is very simple. A house is built with walls so made that they are poor conductors of heat, and the heavy doors must fit very tightly. The rooms may be cooled in different ways. Sometimes brine is cooled in the way you have been told, and it is then pumped through pipes which pass through the storage rooms. The brine takes up the heat from the air, and after it has finished its journey comes back to the tank, where it gives up its heat, and so makes the journey over and over again.

Sometimes the brine pipes do not pass through the rooms, but are arranged in coils outside, and fans drive air cooled by passing over them into the storage rooms. In a few cases, the ammonia pipes pass through the rooms; but this is a great risk, for if a pipe should break or leak, the biting gas would spoil some kinds of food, besides harming any men who happened to be inside. Occasionally, a cold air system is used; that is, air is compressed and then allowed to expand as it passes through the rooms.

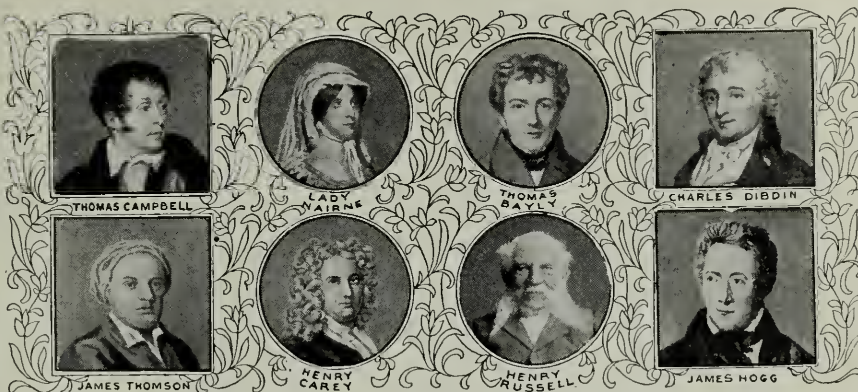
WHY COLD STORAGE IS A GOOD THING FOR US

Are cold storage warehouses a good thing? Undoubtedly they are, though you may hear people talk against them. No doubt, food is sometimes kept in them too long, and when it comes out is not so good for food as it ought to be. Dishonest men sometimes sell cold storage food as fresh, but it is hard to see how people in the cities, at least, could get along without these storage warehouses, for without them the prices of many things would be much higher. Hens do not lay much in winter time, and if eggs were not put away when they were cheap, the price in winter would be so high that only the wealthy could buy them. Then, too, enough fresh meat could not be brought regularly to our great cities, nor could we have many fruits except for a few weeks in the year.

Here is a corner of a cold-storage warehouse, where meat, poultry, butter, eggs, etc., are kept. You may learn in another part of our book that cold hinders decay, that is, the growth of microbes. Therefore meat, eggs, and other things may be kept in cold-storage for months and still be fit for food.

All photographs in this article from Brown Bros.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 3841.



THOMAS CAMPBELL — LADY NAIRNE — THOMAS BAYLY — CHARLES DIBDIN — JAMES THOMSON — HENRY CAREY — HENRY RUSSELL — JAMES HOGG

WRITERS OF FAMOUS SONGS

CONTINUED FROM 3615

THOMAS MOORE

A FAMOUS man once said that he would rather make the songs of a country than make its laws. He meant that songs had such a hold on the people that, if they were good songs, they were better worth considering as a moral power than the laws which are made for us by the legislatures or by Congress. That was going just a little too far. But there is a great deal of truth in the saying. Songs really do have a great influence. Many of us know "Home, Sweet Home," or "The Last Rose of Summer," or "Auld Lang Syne," or "The Star-Spangled Banner," before we know much about the laws of our country. And we get not only ideas and principles from songs, but even powerful incentives to action.

We are going to learn something about our most popular songs and the men and women who wrote them; and we may give first place to Rouget de Lisle, who produced the French "Marseillaise." In his story of the French Revolution Carlyle says of this song: "The sound of it will make the blood tingle in men's veins; and whole armies and assemblages will sing it with eyes weeping and burning, with hearts defiant of Death, Despot, and Devil." One republican general declared that it was worth an addition of a thousand men to his ranks; and a great German poet said that it had caused the death of 50,000 of his countrymen. Its stirring strains and martial music have the power to fill with enthusiasm even people who are not French. It is small wonder then that the song electrifies French people. It expresses all their intense love of freedom, and inspires them to dare and do great things for France.

The author of this grand martial song, Rouget de Lisle, was a captain of engineers stationed at Strasburg just before the French Revolution broke out in all its fury. He was an all-round man: poet, dramatist, violinist, and singer; and he wrote the song in a mood of excitement and inspiration one night in April, 1792. On page 2281 of this book we see him singing the song to his friends. To its strains the soldiers from Marseilles entered Paris, and marched to the attack on the Tuileries.

It was because of this connection with Marseilles that the song was called the "Marseillaise." De

Lisle got a pension from Louis XVIII. on account of the song; and we can see a monument erected to his memory in the town of Choisy-le-Roi, where he died in 1836.

There is nothing even nearly resembling the "Marseillaise" among English songs. "God Save the King," about the origin and authorship of which nobody is really certain, is almost tame by comparison with the fiery French strain. Unless it be "Boyne Water," no one gets excited about any English song; and it is only Irishmen who are apt to get a little warm over that, because it reminds them of the battle on the banks of the Boyne, fought in 1690, when William III. defeated James II.

A STIRRING NATIONAL SONG WRITTEN BY THE POET OF NATURE

But there is "Rule, Britannia," a grand song which Southey, the poet, said would be the battle-hymn of England so long as England maintained her political power. It is a pity we should not be able to say with absolute certainty who is the author of this stirring piece. The difficulty arises in this way: "Rule, Britannia" appeared first in a play called *Alfred*, written in 1740, to commemorate the accession of George I. The authors of the play were James Thomson, the poet of "The Seasons," and David Mallet; and, unfortunately, they did not show, by putting their names to them, just which parts of the play they had each written. Thomson died in 1748, before "Rule, Britannia" became very popular; so he had no special reason for claiming it for himself, supposing it were his.

But experts who have looked into the matter generally give him the honor, and we may safely follow them. "Jemmy" Thomson, as they familiarly called him, was not a great poet, but lovers of Nature and the open air still like to read his book "The Seasons." He took life so easily—so indolently, we should say—that he could often be seen standing in his garden at Richmond, Surrey, eating the peaches off the trees, with his hands in his pockets.

A SCOTTISH POET AND HIS FAMOUS SONGS OF NELSON AND THE SEA

After him we may mention his brother Scot, Thomas Campbell, considered a great poet in his day. He was a Glasgow man, born in 1777, and he wrote his once popular "Pleasures of Hope" when he was only twenty-one. His reputation is not nearly so great as it was, but the British will never forget his war-songs, such as "Hohenlinden," and the magnificent "Battle of the Baltic," describing incidents connected with Nelson's historic fight at Copenhagen in 1801. It was Campbell, too, who sang of "The Exile of Erin," and made "Ye Mariners of England" immortal. The last-named was written in imitation of an old seventeenth-century song bearing the same name, which Campbell used to sing at musical parties in Edinburgh. It is one of the most stirring of his war-pieces.

While we are thinking of this song, let us think of some more sea-songs known to us. The man who wrote the greatest number of sea-songs was Charles Dibdin. Everybody has heard his "Tom Bowling," and if we don't often hear his "Poor Jack," or "I Sailed from the Downs in the Nancy," or "'Twas in the good ship Rover," and other old-time favorites from his pen, we are probably hearing much less entertaining and breezy things.

A WRITER OF SEA-SONGS WHO KNEW LITTLE OF SAILORS OR THE SEA

Dibdin had very little personal acquaintance with either sailors or the sea, but up to his time the British tar had not received much attention in song, and, as Dibdin had a great liking for the plain, manly, honest, patriotic character of the British tar, he resolved to make verses about him. His songs had a real practical effect, for they moved to heroic deeds thousands of England's sailors, besides warming their hearts in hours of merriment, and lightening their dreary hours when prisoners in the hands of the enemy. Poor Dibdin had rather a hard life, but the Government, in his later days, gave him a pension for his sea-songs. He died in 1814, at the age of sixty-nine, and was buried in St. Martin's Cemetery, Camden Town, where a memorial to him was unveiled in 1888.

Of course, there were other writers of sea-songs besides Dibdin. We think of David Garrick chiefly as a great actor, but it was David Garrick who wrote one of the greatest of English patriotic songs, "Hearts of Oak." He wrote it under the inspiration of that wonderful

PICTURE-STORIES OF TWO FAMOUS SONGS

We all know the sad story of "The Mistletoe Bough." The bride of Lord Lovel, on her wedding night, hid for fun in a large oak chest, but the lid closed down and the spring lock fastened her in. Many years later her skeleton was found in the chest. This story was made into a song by Thomas Haynes Bayley.

Another song with a sad story is that of "Auld Robin Gray," which was written by Lady Anne Lindsay to raise some money for an old nurse. The title of the song was the name of a real person, a shepherd, who, when Lady Anne with her brother and sister ran away from home, took them back to their mother.

year, 1759, of which it makes mention—the year of Quiberon and Quebec and Minden, when the British arms were covered with glory by Lord Hawke and General Wolfe and the Marquis of Granby. We know a great deal about Garrick, but we know very little about the man who gave us that other familiar sea-song, "Ben Bolt." His name was Thomas Dunn English. He was an American, a lifelong friend of Edgar Allan Poe, the author of "The Raven," and he died so recently as 1902.

Then we ought to mention Andrew Cherry, who wrote "The Bay of Biscay," and also the best song that we have about "The dear little Shamrock of Ireland." Cherry was the son of a Limerick bookseller. He took to the stage, and appeared, with much applause, as the newspapers said, at Drury Lane Theatre in 1802, ten years before his death. Nor must we forget Samuel J. Arnold, who wrote "The Death of Nelson," one of the greatest national songs. Arnold was very fond of sea subjects, and wrote another once popular song, "Speed on, my Bark, speed on." He was a son of Dr. Arnold, a famous English composer.

A SONG THAT WAS SUNG AGAIN & AGAIN TILL THE SINGER COULD SING NO MORE

"The Death of Nelson" appeared in an opera produced in London not very long after the great admiral's death. Braham, the great tenor, who once sold pencils in the street, had written the music, and it was he who sang it first. The enthusiasm was tremendous. Nelson had been the nation's hero, and this song about him had to be repeated again and again, until Braham was in a state of collapse. Among the sea-songs we must not forget "Rocked in the Cradle of the Deep." It was written by Emma Willard, an American, for whom the school was named. The song would probably not have been so well known had not a clergyman, the Rev. Joseph Knight, made for it the fine tune that we know so well.

But we must think of the soldiers as well as of the sailors. To be sure, there are not so many songs about soldiers as about sailors, perhaps because there is less romance about life on land than about life at sea. But we have "The British Grenadiers," a song about which we know nothing more than this, that the words date from 1690, and that the tune comes down from the sixteenth century. And then we have the favorite, "The Girl I left behind Me," which may be regarded as the property of both soldiers and sailors. It has been played for a century or more when a man-of-war weighs anchor, and when a regiment quits the town in which it has been quartered; consequently it is known wherever English-speaking soldiers and sailors go.

SONGS THAT ARE SUNG WHEN THE NATION IS REJOICING

Your parents remember the rejoicings that took place over the capture of the Spanish ships at Santiago. Well, in the days of the Crimea the English had similar cause for rejoicing, as it was then that they sang: "Cheer, boys, cheer, Sebastopol is taken." That was one of the most popular songs of the day. It was written by Charles Mackay, a Scotsman, who adopted as a daughter the now distinguished novelist, Miss Marie Corelli. But Mackay's words would not have been so popular if Henry Russell had not set them to catchy music.

Henry Russell was a popular song and story entertainer for many years, and he wrote many songs, both words and music, of his own. Many of us know his "A Life on the Ocean Wave," and his setting of Dickens' pretty verses about "The Ivy Green." He was a very realistic singer, and moved his audiences strongly. Once he sang a song which he had written about a Newfoundland dog that had bravely leapt overboard from a vessel and saved a drowning child. At the end of the song, a man in the gallery called out: "Mr. Russell, if that dog is yours, I'll give you a sovereign for a pup."

Russell had been fondled on the knees of George IV., but it is only a few years since he died. It is his son, Mr. Clark Russell, who has given us so many interesting and stirring sea-stories.

SAD SONGS THAT OUR GRANDMOTHERS USED TO SING

Then there was Thomas Haynes Bayly. We do not know his songs so well as our grandfathers and grandmothers used to know them; but we know at least "The Mistletoe Bough," and we have heard of "She wore a Wreath of Roses," and of "Oh, no!

We Never Mention Her," of "I'll hang my Harp on a Willow Tree," and of "Gaily the Troubadour touched his Guitar." Bayly was born in the old town of Bath in 1797, and died in 1839, after years of misfortune. His father was a lawyer, and he wanted his son to become a lawyer also. But the youth took a great dislike to the law. The father then tried him with the Church, but he did not like that either; so at last he joined the ranks of those who looked to literature for a living. There is a fine old flavor about his songs, something like what we should experience, perhaps, if we opened an old bureau and turned over the letters of our grandmothers.

Mr. Andrew Lang says it is "like listening, in the sad, yellow evening, to the strains of a barrel-organ, faint and sweet, and far away." And so it is. Bayly could play beautifully with old romance, and in that direction song has nothing more effective to show us than "The Mistletoe Bough." When the bride got into the ancient chest,

"It closed with a spring. And, dreadful doom!
The bride lay clasped in her living tomb;"

so that her lover "mourned for his fairy bride," and never discovered the whereabouts of her premature tomb.

SOME FAMOUS SONGS THAT WERE WRITTEN ABOUT REAL PEOPLE

It is said that such an incident once really happened. And that may serve to remind us that famous songs have often been made about real people. There is "Annie Laurie," for instance. Few of us probably think of Annie Laurie as having existed in real life. But she did. If we go to Dumfries to-day we may see her "last will and testament" in one of the institutions there. We know that the song begins "Maxwellton braes are bonnie," and Maxwellton is near Dumfries. Well, Annie Laurie was born at Maxwellton, in December, 1682; and to-day she lies at rest in Dunscore churchyard about which Carlyle often speaks in his letters, for he, too, belonged to that district.

Now, this Annie Laurie had a sweetheart—a certain Mr. Douglas—and it was he who made the original of the song about her. But his lines were not very refined, and so they were recast by Lady John Scott. She had no idea that her version of the old song would become popular, but she printed it for a bazaar held on behalf of the widows and orphans of soldiers who had been killed in the Crimea, and it was soon taken up and sung everywhere.

A FAMOUS SONG THAT WAS WRITTEN BY A FARMER'S SON IN TEN MINUTES

Then there is "My Pretty Jane," a song which a great tenor, Mr. Sims Reeves, made immortal by his splendid rendering of it. This song was written by Edward Fitzball, a farmer's son, who used to wander about the lanes of Burwell, a little village some eleven miles from Cambridge. Near one of these lanes "a farmer did dwell," as the song says. He had a daughter, and she was the "pretty Jane." Jane had a bewitching manner, and Fitzball fell in love with her.

One morning he sat down in his father's fields, when the bloom was on the rye, and wrote this song in ten minutes. Later on, he gave the words to Sir Henry Bishop, the man who composed the tune for "Home, Sweet Home," and Bishop produced the melody which has literally gone round the world. It is sad to have to add that "My pretty Jane" died of tuberculosis in the height of her youth and beauty.

"The Lass of Richmond Hill," too, was a real heroine. Some tell us that she belonged to the Richmond in Surrey, perhaps because there is, or was, an inn there called "The Lass of Richmond Hill." But she was the daughter of a King's Bench solicitor who had a place called "Hill House," in Richmond, Yorkshire. Her name was Frances I'Anson. She married Leonard MacNally, an Irish barrister, and it was he who wrote the song about her which has become so popular.

THE ALLEY POET, WHOSE SONG WAS SUNG IN ROYAL PALACES

Still another real heroine was Henry Carey's "Sally in our Alley." Sally was, in fact, a London girl who had gone out one holiday with her sweetheart. Carey happened to notice the pair, and the song was the result of his study of them. All London roared at the idea of making a song on such a subject, and they made Carey very unhappy by calling him the "alley poet." But his song became very popular, and he lived to hear it sung everywhere.

So far, we have not noticed any of the women song-writers. Now, when we come to think of them, it is curious to reflect that many of them were Scottish women; still more curious to note that two of them, at least, wanted to hide what they had done. There was first Lady Anne Lindsay, who wrote the fine ballad of "Auld Robin Gray," for which Mr. Reeves, a Somerset clergyman, made such an exquisite tune. She was one of a family who had long been known for their literary and artistic gifts. Her father was the Earl of Balcarres, and she was born in 1750. Her mother, who was very severe, used to shut her children into dark closets or give them only bread and water when they did anything wrong.

One day the young people decided to rebel and run away. They did run away, but the old shepherd of the place stopped them and brought them back to be punished. Now, the shepherd's name was Robin Gray, and it was the memory of this incident in her young days that made Lady Anne take his name for her song, when she came to write it many years later.

HOW PEOPLE TRIED TO DISCOVER THE AUTHOR OF A VERY POPULAR SONG

The song soon became popular, but she had not put her name to it, and people began to ask about the authorship. Indeed a learned Edinburgh society offered a hundred dollars for the name of the writer. This strikes us as very curious nowadays, when we find everybody rather proud of being able to write. But we must remember that people were not so proud of writing a hundred years ago. We all know how Scott wrote the Waverley novels secretly. People occupying a high station in life thought it undignified to write for print. What Lady Lindsay said about it was this. She declared she had a dread of writing anything "because of the shyness it created in those who could write nothing." In other words, she did not want to make people who could not write uncomfortable in her presence.

Another great woman writer of Scottish songs held the same view. This was Lady Nairne, the author of "The Land o' the Leal" and "Caller Herrin'," and a goodly number of songs about Bonnie Prince Charlie and the fight he made in 1745-1746 for the crown of his fathers. Lady Nairne sent her songs to the publisher under the name of "Mrs. Bogan," and when she went to see him at his office she went disguised.

A SONG THAT BROUGHT COMFORT TO A SORROWING MOTHER

She is best known now by "The Land o' the Leal," which was written to console a dear married friend who had lost her first-born child. That is the meaning of the line, "Oor bonnie bairn's there, Jean"; for the land o' the leal means heaven, and not, as some people think, the country north of the Tweed. Lady Nairne belonged to an old family who had fought and bled for the Stuarts, so it was no wonder that she made so many fine songs about the Jacobites and about the cause which ended so disastrously at Culloden.

But there were other writers of songs about Prince Charlie besides Lady Nairne. There was James Hogg, for instance, better known as the "Ettrick Shepherd"—one of the most wonderful natural genuises that Scotland ever produced. He got little more than six months' schooling, and he was a man before he could write down the letters of the alphabet correctly; yet he gave us such songs as "Bonnie Prince Charlie," "Flora Macdonald's Lament," "Come o'er the Stream, Charlie," and "When the Kye comes Hame." He was a real shepherd, and lived all his days near that Yarrow of which Wordsworth has written so tenderly. William Glen, a Glasgow merchant, should also be mentioned for his "Wae's Me for Prince Charlie," a song for which the late Queen Victoria often asked when anybody was singing in her presence.

THE FAMOUS POET OF IRELAND AND THE BEAUTIFUL SONGS HE WROTE

Of writers of Irish songs which have become famous, quite a number might be mentioned. Perhaps there is nothing more popular than Tom Moore's "Last Rose of Summer," though "Robin Adair," the writer of which we do not know, runs it pretty close. Moore was a perfect master of song-writing, and his "Irish Melodies" included many songs that were once very popular. Some, indeed, such as "The Minstrel Boy to the War has Gone," and "The Harp that once thro' Tara's Halls," are still widely known, and are often heard upon the concert platform. Moore is, without question, one of the greatest

English-speaking song-writers. His sentiments are so beautifully expressed that they appeal not only to the Irish nation, but to the whole Anglo-Saxon race. It was Samuel Lover, the novelist, who gave us "Rory O'More," which became so popular that it was played by most bands when Queen Victoria was crowned. "The Wearin' o' the Green" is always in great request at Irish patriotic gatherings. Both the Irish exile and the Irish patriot find their sentiments reflected in it, and its vein of melancholy appeals to them. There are many versions; but the favourite one is that written by Boucicault, the actor.

The name of the author of "The Cruiskeen Lawn," another popular Irish song which Boucicault introduced into "The Colleen Bawn," is lost to us for ever. But we know all about "Kathleen Mavourneen," the beautiful song which was written by an Irish lady, Mrs. Crawford, and set to music by Mr. F. N. Crouch, who had sung as a choir-boy in Westminster Abbey. Crouch got just $25 for his music—the same as Milton got for "Paradise Lost"—but when the copyright was sold some years ago it realized the substantial sum of $3,000.

Henry Carey, who was at one time thought to be the author and composer of "God Save the King," is best known now by his popular song "Sally in our Alley." Carey wrote this song after seeing a London girl of the poorer class out for a holiday with her sweetheart, a scene beautifully pictured here by the artist.

It was the music of Michael William Balfe that made the song of "Killarney," written by Mr. E. Falconer, known in all English-speaking lands. If Balfe had written nothing but this song and the opera of "The Bohemian Girl," his name would have been handed down to posterity.

There are many more songs which can be mentioned only briefly, such, for example, as the famous "Cherry Ripe," the words of which were written by Robert Herrick, and the "Vicar of Bray." It is difficult to close without mentioning a dozen others. Some of them are given in the BOOK OF POETRY.

In another article on American songs you may learn all about "Yankee Doodle," "Dixie," "The Star-Spangled Banner," "John Brown's Body," "When Johnny Comes Marching Home," and many another lyric, the lilting melodies of which are known wherever English is spoken as well as they are known to us.

We mentioned one French song in the beginning of this story. There are others hardly less famous, and other countries also have their famous songs. We shall now take a little space to tell you of some of them.

The stirring "March of the Men of Harlech," the Welsh national song, was written some centuries ago, but no one knows who the writer was. The same thing is true of the famous Danish national song "King Christian Stood Beside the Mast," which you may read on another page. It was written in the seventeenth century, and commemorates a battle between Christian IV and the Swedes in 1644. It was this same Christian who went to the aid of Bohemia at the beginning of the Thirty Years War.

The "Watch on the Rhine," one of the best known of the German national songs, was written by Max Schenckenburger, a young merchant who lived in the town of Thalheim, in Würtemberg. It is not known that he wrote anything else; but this one song has had a tremendous influence on the German people.

In 1870, when the king of Prussia was going to war with France, the "Watch on the Rhine" was chosen as a marching song for the army. It at once became popular and by common consent was made the national song for the new empire. Its writer had died some years before this, and few people stop to inquire his name.

"Adelaide," a very famous song which was set to music by Beethoven, has a history which is almost as romantic as the story of Annie Laurie. It was written by a poet named Friedrich Matthisson, the son of a poor clergyman. In his youth the poet was a reader in the household of a German princess, who had a beautiful maid of honor named Annette von Glafey. Maid and poet loved each other, but, alas, the maid's father forbade their marriage, saying that his daughter must choose between marrying a husband of her own rank, or becoming a nun. Refusing to marry a man whom she did not love, Annette chose the convent. She entered the abbey of Mosigkan, of which in time she became abbess. She lived to be a very old woman, and died less than a hundred years ago. The poet, who married another lady, also lived to a good old age, and in his later years was made a noble by the king.

"Il pleut, bergere, il pleut, bergere" (The Rain is Falling, Shepherd Maid), is a tender little French song which is familiar to all children, and to the grown up people of France too. It was written in the eighteenth century by a poet named Philippe François Fabre, who signed himself Fabre d'Eglantine. In the time of the Revolution, Fabre became secretary to Danton, one of the revolutionary leaders. When Danton fell from power, Fabre fell with him, and met his death on the guillotine. Of all that he wrote, this pretty song is all that is remembered.

Fabre's birthplace, Carcassonne, is famous for its wonderful medieval fortress; but to the minds of many people is more famous for a ballad, written by Gustave Nadaud. Of course a ballad can scarcely be called a song, but Nadaud wrote many songs, which are, however, not well known by English-speaking people. He lived in Roubaix, a noisy manufacturing town in the north of France, and it is possible that he never saw the town whose name his musical verses have made familiar to many. Travelers say that these two men between them have in their simple verses given a truer picture of the lives of the French peasantry than the writers of many books have been able to do.

No one knows who wrote the famous old French song, "Malbrough s'en va-t-en-guerre," which may still be heard among the French Canadian habitants. Some people say it was written about the great Duke of Marlborough; others say it was written long before his time. At any rate, it was sung by his nurse to the baby son of Louis XVI and Marie Antoinette. Marie Antoinette learned it; pretty soon the whole court was singing it. It was taken up by the revolutionists. Napoleon sang it; and its echoes have come to us in the rousing chorus "We Won't Go Home until Morning."

A young French poet named Jenneval wrote "La Brabançonne," or the song of Brabant, the national song of Belgium, each verse of which ends with the words "For King, for Law, for Liberty." The poet joined the Belgians in 1830 in their fight for independence and fell in battle.

Nearly all the nations of to-day have national songs into the singing of which the people put all the passionate love of country which is implanted in the heart of every true man and woman. You will find the words of these national anthems in the Book of Poetry, where you can also read something of the lives of the writers when their names are known.

THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 3935.

WHERE DO SHELLS COME FROM?

CONTINUED FROM 3685

THE shells in the sea are the little houses that living creatures have made for themselves from their own bodies. The sea is crammed with life from the surface to the bottom, and from its edge on the shore to its centre. A very large number of the living creatures in the sea make shells for themselves, partly to protect them from the fishes, that would like to eat them, and partly to protect them from the force of the water.

We call these creatures shell-fish, but the name is a very bad one. No fish makes a shell, and these creatures are not fishes at all, but far lower in the scale of life. A fish is an animal that has a backbone and a skeleton that lies inside its body. The bodies of the creatures that produce the shells of the sea are soft, and have neither a backbone nor any other bones.

These kinds of creatures existed in the sea long before the fishes were evolved at all. When they die, their bodies are gradually dissolved away, but the empty shell that was made by them remains. It is now much lighter than it was, for its inhabitant is not there to fix it to a rock or a seaweed, and so it is cast up by the waves on the shore, where we find it. Sometimes, when we dig far inland, we come across many minute sea-shells deep down in the earth. These shells prove to us that at one time, long, long ago, the sea used to cover that place. As the little creatures died, their shells dropped to the bed of the sea and were gradually covered by layer upon layer of mud, until that which was previously the sea-bed at length became dry land.

HOW CAN WE TELL WHAT IS AT THE BOTTOM OF THE SEA?

We do not yet know all about the bottom of the sea, but there are several ways in which we can learn something of it. We can comfortably study a great deal of what was once at the bottom of the sea, when the sea has gone somewhere else, and has left it high and dry. For instance, we can study chalk cliffs, and learn from them a great deal about what the bottom of the sea is like, or has been like.

Then we can send divers down to the bottom of the sea where it is not very deep, and they can look through the glass plates in their diving-helmets, and can see the plants and animals of many kinds that live at

the bottom of the sea. They can bring some of these up, and at the New York Aquarium we can see for ourselves, at close quarters, many of the wonderful creatures that live at the bottom of the blue sea, such as sea-anemones.

But divers cannot go down many scores of feet, and the sea is often miles deep. It we want to learn about the deeper parts of the sea, we must dredge them—that is, let down something that will scrape along the bottom, and catch hold of anything that will come away; and then the catch can be hauled up to the surface, and we can study it. This is costly, and takes time, but much of it has been done, and we have already learned a great deal about the bottom of the sea by this means.

WHAT MAKES WATER GURGLE WHEN IT COMES OUT OF A BOTTLE?

We know that the air has a pressure, and so, if there is an empty space anywhere, the air will press into it. Now, when we pour water out of a bottle which is full, there must be an empty space left behind in the bottle when the liquid comes out, and from moment to moment, as that empty space tends to be formed in the bottle, the air outside is bound to rush in to take its place. If the bottle has a wide mouth, like a tumbler, then, as we pour the liquid out, air can flow in evenly, and there is no gurgling.

But if we take a full ginger-ale bottle, and hold it upside down, then there is a series of fights going on between the liquid, which is trying to get out under the pull of gravitation, and the air, which is trying to push its way past the liquid to fill up the space in the bottle. Sometimes the air pushes back the ginger-ale, and sometimes the ginger-ale pushes back the air. This means that the air is thrown into little disturbances, which we hear as gurgles. We say that water gurgles, but really, of course, it is the air that is disturbed by this contest between it and the water, and we call these disturbances "gurgles."

WHY DO EMPTY VESSELS MAKE MORE SOUND THAN FULL ONES?

In the study of sound we soon discover the existence of things which help to magnify a sound. The virtue of these things is that they resound, and so they are called *resonators*. The body of a violin is a resonator, and so are our chests and the spaces of the mouth and nose when we sing. If we play a violin from which the body has been taken away, the sound is weak, and thin, and ugly, and the difference between a violin worth $10,000 and one that is not worth $25 is to be found in the body, or resonator. The whole point about a resonator is that the air inside it can be thrown by it into sound-waves. If there is no air inside it, of course its use is gone. An empty vessel is a resonator. If it is filled with fluid, it can no longer act; it makes far less sound, and the weight of the fluid quickly stops what sound it does make, acting like the dampers in a piano. If we were to fill the body of a violin with water, we should get the same result as if we held the body of the violin tightly in our hand when playing it.

WHY, IF WE TOUCH A GONG, DOES THE SOUND CEASE?

The sound of the gong, like all other sounds, is due to waves of air that strike against the little drum inside our ears and are translated by the nerves of hearing into what we call sounds. These waves in the air are made by something. In the case of a gong or the string of a piano, they are made by a vibration which has been produced by striking the gong or the string. When we play a note on the piano, a hammer strikes a string; if we let go the note, the sound stops. It stops for exactly the same reason as the sound of the gong stops.

When we touch a gong, we stop its vibrations, and therefore we stop the movements of the air which those vibrations were causing. If we are doubtful as to what a vibration really is, we only have to touch the gong gently after striking it, and we shall understand. In the case of the piano, when we let go the note we have just played, the sound ceases at once, because the damper, as it is called, which was raised from the string when we played the note, is allowed to fall on it again, and damps the vibrations. We do exactly the same when we have accidentally struck a tumbler and set it ringing; if we handle it, it stops.

WHY CANNOT WE FEEL AIR-WAVES WITH OUR HANDS?

This is simply a question of the delicacy of the sense of touch. Our hands can and do feel air-waves of

certain rates and sizes. When we fan ourselves, we feel air-waves, and we also feel them when someone suddenly shuts a door, or when we stand on a station platform and an express train whizzes by. But when the air-waves are very much smaller and quicker, we cannot feel them with our hands, but we feel them with our ears, and then we call them sounds. Some of the very largest and slowest air-waves that can just be heard by our ears, as a very deep, faint, low sort of boom, can also be just felt by our hands. This, of course, depends upon the limits of hearing in the person in question, for some people can hear much lower notes—that is to say, much slower waves—than others.

WHY CAN IRON FLOAT ON MERCURY IF IT CANNOT FLOAT ON WATER?

All questions of floating and swimming and flying depend on the comparative differences between various things as regards gravitation. Iron is heavier than water, or, as we say, its specific gravity is greater than that of water. Iron must therefore sink in water. Mercury is heavier than water, and therefore mercury must sink in water. But mercury is heavier than iron, and it must therefore sink in iron, which is just a peculiar way of saying that the iron must float on the mercury. The thing with the highest specific gravity is the thing for which the earth has the strongest pull. It therefore gets nearest to the earth, and anything else must float on the top of it.

WHY CAN IRON BE BENT WHEN HEATED?

We all know that things vary very much in the way they behave when something tries to alter their shape. Some things will rather break than bend; others will bend and then come back again to their old shape; yet others will bend and stay in the new shape, even when the bending force is removed. Various special names are applied to these different properties of matter. A general rule that applies almost always is that the colder a thing is, the more rigid it is. This applies even to the three great states of matter, solid, liquid, and gaseous, for it is only in the coldest of these—which is the solid state—that things can have any rigidity at all, and, as a rule, the colder a solid thing is, the more rigid it becomes. This, as the question suggests, is true of iron. We believe that when a thing is made hot, the molecules of it are thrown into a state of greater motion, and we know that they are farther apart, for the thing expands. But if the molecules are farther apart than they were, and if they are moving about more violently than they were, they cannot be holding on to each other so tightly and rigidly as before, and so the thing which, when it was cold, could not be bent, can now be bent. Directly we understand the nature of heat, we see how reasonable it is that iron should behave as it does.

WHY IS COAL THE BEST THING FOR MAKING A FIRE?

We ought not to say that coal is quite the best of all possible things to burn for making heat. The best fuel is really hydrogen; in other words, we get more heat by burning a given quantity of hydrogen than by burning the same quantity of any other substance that we know. That is why we burn a mixture of oxygen and hydrogen when we want to heat a piece of lime to make the light in a magic lantern. Of course, the objection to using hydrogen is the very great expense.

The advantages of coal are its cheapness, its dryness, and especially the fact that such a large proportion of it is burnable. Coal itself contains a good deal of hydrogen, and is good so far; but the carbon of which it mainly consists is itself a fuel which is scarcely inferior to hydrogen, and as there is practically no water in coal—except, of course, the water that is made when the hydrogen of it is burned—we benefit by the heat that is made; whereas, if the coal had had a good deal of water inside it, that water, as water always does, would catch up the heat, and we should lose it. All the same, the time is rapidly approaching when we shall produce heat in better ways than the burning of crude coal in stoves and furnaces.

WHY DOES SMOKE ALWAYS COME FROM A FIRE?

There is no real reason why smoke should always come from a fire, and already there are many ways of making fires which produce no smoke. The time is not very far off when no one will be allowed to make fires that produce smoke. The reason why smoke comes from our ordinary fires is the same as the reason for a great many

other facts that we can notice. It is, indeed, the reason which explains the making of the coal in the first place. Carbon will not burn unless it is hot enough, and it is less easily burned than most of the other things that can burn. So a certain quantity of carbon is apt to go unburned, though this will happen far less if we keep the fire hot enough, which is to be done by giving it a good supply of air. If we make a forced draught, and keep up a steady, quick flow of fresh air—that is to say, of fresh oxygen—to the fire, then we shall find that all the carbon is burned up, and no smoke is produced. Smoke is always a sign of failure and waste, even if there were nothing worse to say about its consequences.

WHY IS THE FIRE HOT?

The heat that we feel when we stand opposite a fire is of two kinds. Partly, it is the heat in the air which the fire has made warm, and which we feel against the skin. That heat has flowed into the air from the hot fire, but by far the greater part of the heat we feel opposite the fire is what is called radiant heat, a thing which is exactly of the same nature as light, only that instead of *seeing* it we *feel it hot.* So our question is: What happens in the fire that makes it produce the heat of both kinds that we feel? It will be quite plain to us that when heat is being produced something is being done, something is being made, and we know that the power has to come from somewhere. It comes from the carbon in the coal and the oxygen in the air.

They have energy and power locked up in them which are, so to speak, released when the carbon and oxygen combine to make the fire. The proper way of saying this, as we read on page 3592, is that the potential energy of the carbon and oxygen are changed, when they combine, into heat energy. This heat shows itself in a rapid motion, we suppose, of the matter in the fire. This communicates itself to the atoms of the air, making them hot, and it also starts the waves in the ether which we call radiant heat.

WHY DOES STEAM PUT A LIGHT OUT?

Of course, it depends upon the kind of light whether steam will or will not put it out, but it is certainly true, as we all know, that a fire or a lighted gas-jet or a lamp may be put out by steam. For this there are at least two reasons. We use the word steam rather loosely, often meaning by it liquid water in the air—the steam that we can see. But sometimes we mean by it water-vapor. Wherever there is steam, there is water-vapor—that is to say, water in the air in the form of an invisible gas. Now, this water is already burned; it can neither be burned any more, nor can it sustain the burning of anything else.

In so far as the thing which produces the light is supplied with water-vapor in the air instead of oxygen, it is starved and must go out. But the presence of steam means also the presence of liquid water, and liquid water puts a light out because it so quickly swallows up into itself the heat which is near it, and makes the burning thing so cold that it cannot burn. Every man who smokes a pipe knows the great difference there is between smoking moist tobacco and dry tobacco.

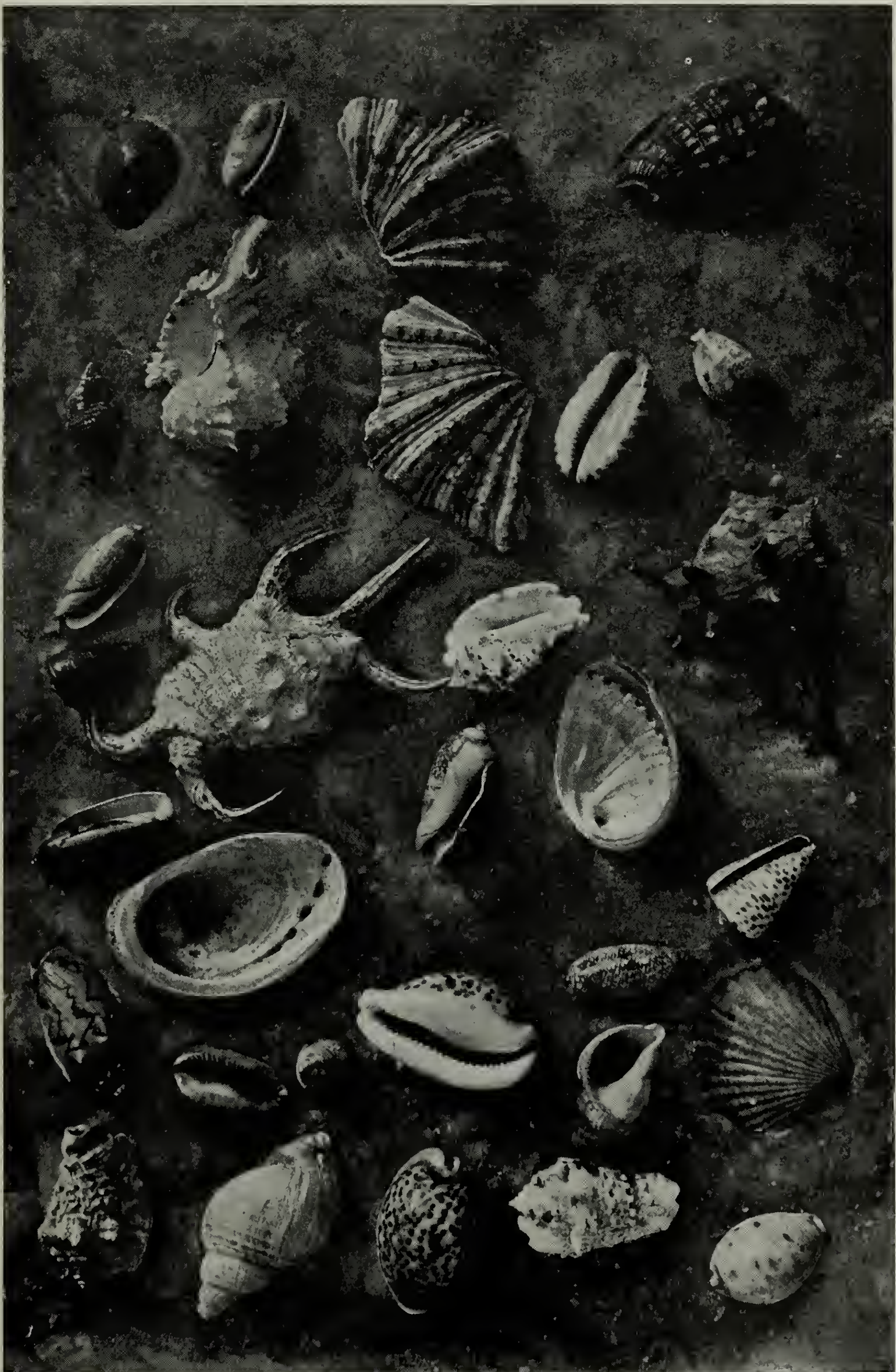
WHY DOES NOT THE COLOR COME OFF SOAP?

We often notice that the color comes off things, and the reason, of course, is that the color is only on the surface, and if the surface is scraped, or rubbed, or worn away, the color goes with it. But many things are colored, though they are not painted. We might say why does not the color come off a brass fender, or off a silver spoon, or off a gold ring? The color does not come off in these cases for the same reason that explains why it does not come off soap. The soap, like the fender or the silver spoon or the gold ring, is made throughout of colored material.

IS THERE A COLOR THAT OUR EYES CANNOT SEE?

It is our brains that translate into color something outside them which we call waves of light. If there were no brains, those rays of light would still exist, but, plainly, it would not be proper to say that they were colors. Now, what happens in the case of light is that, if we compare all the possible kinds of light to the notes on a piano, there is just about one octave in that large compass that our eyes can see. The notes above and below that octave are in all real particulars of the same kind, but our eyes cannot see them.

THE WONDER AND BEAUTY OF SEA-SHELLS



The poets have sung of "the rainbow-tinted shell," with its colors of sky and flower and gem and plant. But the hues of the shells are not more wonderful than their myriad shapes, with whorl and spire and scroll, which Tennyson calls "a miracle of design," and which sculptors and artists have copied again and again.

If our eyes could see them, they would certainly be of different colors to the light that we can see. The notes below the red end of the octave that we can see would appear as some other color which, of course, we cannot imagine; and the notes above the violet end of the octave we can see would appear as another color. It has been clearly proved that some insects, such as ants, can see these rays of light beyond the violet, to which our eyes are blind. But what color it looks like to them, of course, no human being can ever tell. It is very interesting to know, however, that there are animals which can see notes of light which we cannot see, just as there are animals which can hear notes of sound too shrill for our ears to hear.

WHY DOES A DIVER NEED LEAD ON HIS BOOTS TO MAKE HIM SINK?

The diver would certainly sink without the lead on his boots. His body itself is heavier than water, and though the small quantity of air between himself and his case tends to make him float, yet the metal round his head makes him heavier still. The point about the lead on his boots is that it makes him sink in the right direction. If it were not for that he might sink head first or sideways, and might find it exceedingly difficult or impossible to right himself. The lead serves, in a way, the same purpose as a piece of lead placed at the bottom of those little toys which cannot be upset, however much they are pushed about. A closer parallel still is the case of the balloon, which is kept the right way up by having its heaviest part below.

WHY IS SALT DAMP WHEN IT IS GOING TO RAIN?

When we say that the salt is damp, we mean that it has taken a lot of water into itself, and of course it has absorbed the water from the air. Common salt, like a host of other things, will help itself to the water in the air, though many other salts will do so far more readily than common salt does. We are speaking, of course, of water that was in the form of gas, making up one of the gases in the air. Plainly, the reason why salt becomes damp before it rains is that before it rains there is an unusual amount of water-vapor in the air. Indeed, the rain is due to the fact that the water-vapor in the air has become too great an amount for the air to hold it any longer, and so down it tumbles in the form of rain. When raindrops form, we know that the water-vapor of the air condenses in little drops around particles of dust, and so on, in the air. Well, that is exactly what happens when the salt becomes damp. The water-vapor in the air has condensed upon the particles of salt.

WHY DOES THE SUN MAKE OUR HANDS AND FACES BROWN?

For a long time the answer to this question was very uncertain. Doctors used to have the idea that every change produced in the body out of the ordinary was a disease—was something wrong. But a great many of these things that are too often looked upon as diseases, or as something wrong, are really instances of the marvelous power of the body to adapt itself to special circumstances. In this case, for instance, it used to be thought that some injury was done by the browning of the skin.

What really happens is that the skin turns brown in order to protect the blood underneath it from the too strong rays of the sun. The brown paint, or pigment, as it is called, that is formed in the skin catches up the sun's rays and absorbs them, and so the precious blood that runs in thin-walled blood-vessels just under the skin is protected.

Sunlight is exceedingly good and necessary for us, but there is only a certain intensity of it that is good, and beyond that it becomes harmful. People vary very much in the extent to which they brown under the sun. It is said that the people who can live best in the tropics are those in whom the skin has the best power of making the brown pigment to protect the body. It may be that the deep color of dark races is protective, and that is why we find darker peoples nearer the tropics and fairer peoples nearer the poles.

WHY DOES THE SURFACE OF WATER NEVER CURVE OR SLANT?

Water, like everything else, is under the influence of gravitation. All the parts of it must therefore get as near as possible to the centre of the earth. In the case of a solid thing, those forces which hold it together partly oppose the force of gravitation, and so an india-rubber ball, for instance, will remain as a ball, though if it were melted it would

run flat out on the table as water would. But when we come to consider what the shape of the earth is, we shall see that our question is not quite right if we are to read it strictly. The earth is a ball, and if water is to obey the law of gravitation and get as near the centre of the earth as possible, it follows that the surface of water must always curve, and its curvature, as we say, must be the same as the curvature of the earth.

The water in the smallest pool or basin must obey this law, but, of course, the curve is so slight that we cannot see it. If, however, instead of a pool we take a huge lake or the ocean, we can see for ourselves that the surface of the water is curved, because we can see how a ship leaving us sinks beyond the curve, or a ship coming over the horizon rises up as it approaches us. So the real answer to this question is that the surface of water is *always* curved; and it is always curved in one way—the way in which the earth is curved—and that is what the question really means.

WHY DOES NOT A NEEDLE GAIN WEIGHT WHEN MAGNETIZED?

This question puzzles us because we have not clearly distinguished in our minds what weight really is and what it is not. All weight is a direct consequence of gravitation, and of nothing else. Were there no gravitation, there would be no such thing as weight. The power of gravitation entirely depends upon the amount of stuff that is concerned, or the mass of matter that is acted upon. In other words, the weight of a thing depends entirely upon its mass—the amount of matter in it. Everything goes to prove that nothing affects gravitation except this question of the amount of matter present.

If we take a needle and heat it or cool it, magnetize it or unmagnetize it, or do anything else to it, so long as we do not take away any of the matter from it or add any new matter to it, its weight remains the same. When we magnetize it, we endow it with a new power which is very strong and wonderful, and which, for instance, can be brought to bear in such a way that it will overpower the force of gravitation, and will thus enable the needle to lift ten times its own weight. But the weight of the needle itself absolutely depends upon its mass, and upon nothing else. Our bodies weigh just the same whether we hold a weight in our hands or not; the amount of stuff in our bodies is the same in either case. Of course, our bodies and the weight together weigh more than our bodies would alone, but that is a different thing.

DOES EACH PLANET HAVE A LAW OF GRAVITATION?

The law of gravitation is not a question of any planet or star. It is a universal law. It is equally and strictly true of every particle of matter everywhere, and applies strictly between that particle of matter and every other particle, whether near or far. For us on the earth, the most important kind of gravitation is the earth's gravitation; that is simply because the earth is so near. But a book, which rests on a table under the pull of the earth, is also being pulled towards the sun, and the moon, and every star in the sky. Only the earth, being near, has the advantage, and that is why it is the downward pull we know so well, and usually call gravitation.

In the case of any of the bodies of the heavens, this downward pull depends upon its mass. Thus, if we could exist on the surface of the sun, we should find the downward pull vastly greater than here; on Mars less than here; on the moon still less, and so on. But if we think this over, we shall see that it simply means that gravitation is true everywhere, and that it is not the best way of putting it to say that each planet has a law of gravitation.

WHY ARE THERE MORE STARS IN THE SKY SOME NIGHTS THAN OTHERS?

Of course, we know very well that there are not more stars in the sky some nights than others, but that it is a question of what we see. What really happens is that the state of the atmosphere differs very much at different times, quite apart from the presence of actual clouds. Even when there are no clouds anywhere, and all over the sky the brighter stars can be seen, the state of the air may be such—whether owing to the presence of a lot of dust high up in it, or to other causes—that the less bright stars cannot be seen. The temperature and the pressure of the air have their own effects in this respect. Much of the recent advance in astronomy has been due to the fact that

great new observatories, containing the finest telescopes in the world, have been specially built on the tops of mountains, or, at any rate, as high up as possible in parts of the world specially chosen for the clearness of the air; and the higher the telescope, of course, the less the amount of even clear air that the light from the stars has to pass through before it reaches the eye of the astronomer or the lens of the camera.

HOW CAN WE TELL HOW MANY DAYS THERE ARE IN A YEAR OF A PLANET?

If we know how long a planet takes to go once round the sun, then we know the length of its year. Then, if we can watch the planet, and see how long it takes to spin round once on itself, we know the length of its day. Divide the length of the year by the length of the day, and we have the number of days in the year. But though that is quite easy in some cases, in others, unfortunately, it is impossible, and so we cannot yet tell the number of days in a year of any planet. The trouble is that, though we know how long the planet takes to go round the sun, in some cases—as, for instance, in the case of Neptune—the planet is so far away that we cannot make out any of the features of its face, and therefore cannot tell at what rate it spins, or even that it spins at all, and we do not know the length of its day, though we do know the length of its year.

DO THINGS WEIGH HEAVIER OR LIGHTER WHEN HOT OR COLD?

This question about gravitation is really extremely interesting, because it so happens that this is one of the very questions on which a great many remarkable experiments have quite lately been made. There is no doubt about the answer to it, but we must understand what that answer really is. It is that the power of gravitation is not in the slightest degree affected by temperature; in other words, one and the same thing—if nothing is taken from it or added to it—weighs just the same, however much it is heated, or however much it is cooled. But we must not be confused. When a thing is heated it swells, as a rule, and as there is no more of it there, but it is occupying more space, it is made lighter *in proportion to the space it occupies.* Thus hot water will float on the top of cold water; hot air will rise in cold air, and so on. This, however, is not a question of absolute weight, but of the relation between that weight, *which is not changed,* and the volume of the thing.

DO EAR-RINGS AFFECT OUR EYES?

I do not know anything good that can be said of ear-rings, said the Wise Man; but, of course, we must not say any evil of them that is not true. It is utterly untrue that piercing the ears, with or without the wearing of ear-rings, has any effect at all upon the eyes. There is no reason whatever why it should have such an effect, and hundreds of thousands of cases every day prove, of course, that it has not. Perhaps, if we want to say the best we can for ear-rings, we must add that, at any rate, they do less harm than nose-rings, which are worn for the same reason—that is to say, for ornament—by many savages.

IF LIGHT IS A WAVE OF AIR, DOES THE LIGHT-WAVE GO THROUGH GLASS?

Light is *not* a wave of air; it is a wave in the ether, and this ether is everywhere—in the air and in the glass, too. When the light passes through glass, it is a wave in ether all the time, though during part of its journey the kind of matter called air is there, too, and in another part the kind of matter called glass is also there. This is not to say, of course, that matter has no effect on these ether-waves, for we know that it has. All we can say is that some kinds of matter offer no great obstacle to their passage, as, for instance, glass; while other kinds of matter, as, for instance, wood or stone, interfere very much with their passage. Sound *is* a wave of air, and where sound passes through glass, the air-wave on the outside throws the glass into a wave of the same kind, and the wave in the glass starts a new wave in the air on the other side, and so the sound goes on.

DOES AIR DISSOLVE IN WATER?

Certainly air dissolves in water, and the pleasant taste and sparkle of nice drinking-water are due to the air dissolved in it. If we are in some part of the country where we are not sure about the water, and fear there may be dangerous microbes in it, perhaps we boil it in order to kill them. When we boil it, we drive out the air which was dissolved in it, and if we keep up the

boiling for some time, we do this very completely. As it cools, the water dissolves a little more air in it again, but we shall still find it very flat and dull to drink. The thing to do is to pour it a long distance through the air from one vessel to another a few times, and then it will become sparkling and pleasant again. When we go on boiling the water we use for making tea or coffee, we spoil the beverage, because we drive out the air dissolved in the water. The water in a shallow running stream will, of course, be richest in air, and that is the kind of water which was praised ages ago as the best with which to make tea. If air did not dissolve in water, no life of any kind could exist in water.

IF THE EARTH IS A BALL, WHY DOES AN EARTHQUAKE SHAKE ONLY PART OF IT?

People who study these things now tell us that we really need two words for what happens in what we call earthquakes, and this question suggests exactly the point they make. We should really speak of *earth-quakes*, and of *earth-shakes*. In an earth-shake, the whole earth is shaken as it rolls through space, and this must happen because the earth is a ball, and we cannot shake part of a ball without shaking the whole of it.

But if the ball is a very big one, as the earth is, and if it is made of a great many different parts, including a crust of many layers, it is quite possible that we might have a disturbance somewhere that shook one of these layers against another, without shaking the ball as a whole; and that is the kind of disturbance that we should call an earthquake, and not an earth-shake.

DOES AN EARTHQUAKE TRAVEL THROUGH THE EARTH?

Even though what is stated in the last answer is true, a wave of disturbance would start from the place where the crust of the earth was moved, and that wave would travel through the earth.

That is what happens in every earthquake. Instruments are made that will show that an earthquake has occurred even thousands of miles away, by noting that a wave of shaking has traveled through the crust of the earth. So, in every case, our question is really answered by saying that, though a serious result may only happen at one place, where the earth's crust is disturbed, yet a wave of shaking always passes from that place right through the crust of the earth.

WHY CANNOT WE BREATHE UNDER WATER?

As we know, there is air dissolved in water, and it is this fact that enables creatures to exist under the water. Now, a fish has a special part of its body made for the purpose of getting the air out of the water. The water is taken in by the fish, and allowed to flow along very close to thin blood-vessels in what are called the gills.

As the water flows past these blood-vessels, it gives up to them part of its oxygen, and takes from them their carbon dioxide. But we have no gills, though there is absolute proof in our bodies, when they are very small, that we are descended from creatures which did have gills. Gills are only adapted for breathing in water, and the fish dies of suffocation in the air. Our lungs are only adapted for breathing air, and we die of suffocation in the water. Besides, our needs of air are much greater than those of a fish, and even if our lungs were capable of getting the air out of water that might be inhaled into them, there would not be enough to keep us alive.

WHAT DOES A "BIRTHRIGHT" MEAN?

In nearly every part of the world, at one time or another, alike among savages and among civilized people, the eldest child, or, rather, the eldest son, has special rights and privileges over the others. He often inherits most or all of his father's property, and has a special right to his father's title and position whether as chief of a savage tribe or as a duke or king or whatever it may be in a civilized country.

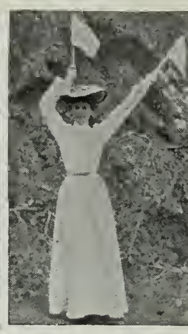
This right of the first-born is called his birthright, and the Bible story of Esau and Jacob is sufficient to tell us how old this custom is. It has a special long name which we shall certainly meet sometimes, and which we must therefore learn. This name is primogeniture, and really means first being born. In some parts of the world this law of birthright or primogeniture has been abolished, and sons inherit equally, and have equal rights. France led the way in this respect, probably as a protest against the ancient custom of titles being transferred from father to eldest son. In this country all children, whether sons or daughters, inherit equally.

THE NEXT QUESTIONS ARE ON PAGE 3905.

HOW TO SIGNAL ACROSS A FIELD


Ready to start


Letters follow


Numbers follow


Cancel previous signal


T


E


A


I


S


R


E


A


D


Y

These pictures show how we can "speak" across great distances. In the top row the first picture shows the signal "Ready to start"; the second means "The signs that follow are to be read as letters"; the third means "The signs that follow are to be read as numbers"; and the fourth means "Cancel previous signal." The other pictures convey the message "Tea is ready," each picture representing a letter.

HOW TO SPEAK BY SIGNS

CONTINUED FROM 3644

THE military method of semaphore signaling, or "flag-wagging," as it is sometimes called, is a splendid way to exchange messages with those who are far beyond shouting distance, but still in sight—as on the golf-links, across a lake or river, or a long stretch of seashore. A semaphore message will carry as far as the signaler and the person to whom he or she is signaling are within sight of one another, while the apparatus for signaling is simplicity itself, a couple of semaphoring flags being readily manufactured in a few seconds from two white pocket-handkerchiefs, which may then be pinned on to a couple of sticks cut from the nearest hedgerow, or on to any couple of odd bits of driftwood found lying about.

For instance, if we are having a picnic on the beach, and the boys have wandered off while the girls prepare tea, it may be convenient to recall the former, and for this purpose no message is more effectual than that shown by the second, third, and fourth row of pictures opposite, which spell the words "Tea is ready."

Practice on paper might alternate with practice out of doors across a lawn, until the letters come almost mechanically, and after a day or two's practice it will be found possible to send long messages at a fairly even rate of speed.

It is an excellent plan to practise sending messages before a long looking-glass, as we learn in this way to send and to *read* a message at the same time. It otherwise takes much longer to learn to *read* signals sent by semaphore than to send them.

LETTERS AND SIGNS OF THE FLAG ALPHABET

The letters of the semaphore alphabet are shown in the picture on this page. Imagine the thick lines to represent the body of the person signaling, and the thin lines to represent the flags held in the hands. The letter A is represented by holding the right-hand flag as if it were pointing midway between the VII and VIII of a clock-dial, assuming the feet of the signaler to be at VI and his head to be at XII. If we look at the picture of the signal A in the message on the page opposite, it will be clear. It is good practice to write the alphabet signals on a piece of paper, beginning by writing out the entire alphabet a few times, and then by writing different letters at random, without consulting the alphabet, thereby testing our memory. Then we can write words, and thus send letters to our friends who understand the system of flag-signaling.

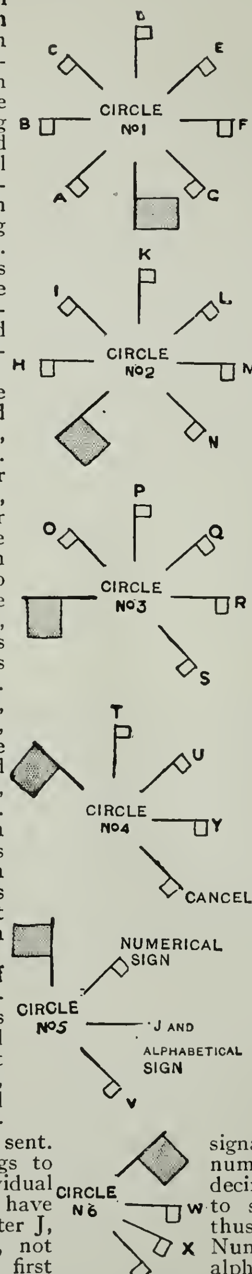
Another way to assist our memory is to study certain circles of flags. Looking at circle No. 1, seen on next page, we see that A, B, C D, E, F, and G are signaled by letting the flag in the left hand hang down in front and by changing the position of the right-hand flag. From circle 2, on next page, it will be seen that the letters H, I, K, L, M, and N are made by holding the right-hand flag in the position of A, and by moving the left-hand flag to the positions placed opposite the letters. Then the third circle, which illustrates the letters O, P, Q, R, and S, shows the right-hand flag at the B position, and the left-hand flag moved round as indicated. If we look at the letter R, as shown in our "Tea is ready"

message, it is made plain to us. The fourth circle shows the letters T, U, Y, and the sign for "cancel," all of which are made by keeping the right-hand flag in the C position and changing only the position of the left-hand flag. We can compare this circle with the photograph of the letter T, as shown on the photograph page. Circle No. 5 shows the right-hand flag in the D position, where it is held when indicating the numerical sign, and also for J, or the alphabetical sign, and for V, the position of only the left-hand flag being changed for these different signs. Finally, the sixth circle shows that the letters W, X, and Z are indicated by holding the right-hand flag in the E position and changing the position of the left-hand flag only.

Probably the meaning of the words "alphabetical sign" and "numerical sign" is not clear, and we shall have it explained. There are no special signals for the numerals, A standing for 1, and other letter signs for other numerals, as seen in the picture on the preceding page. But in beginning a message, if it is to consist of letters, we make the signal for alphabetical sign first, thereby showing that the signs that follow are to be read as letters—A, B, C, and so on. Similarly, if, at the beginning, or in the course of a message, we wish the signs that are going to be made to be read as numerals, and not as letters, we make the numerical signal. The "annul" or "cancel" sign almost explains itself. It means that we wish the previous sign sent to be canceled, perhaps because we have discovered that we have made a mistake in transmitting.

Having seen the meaning of the various signs, we can proceed to see how a message is sent. To begin, we must stand in the position shown in the first picture on the photograph page, with the two flags slightly crossed over one another, facing the direction in which the message is to be sent.

We must next move both flags to attract the attention of the individual to be signaled to, and when we have succeeded, we must signal the letter J, which shows that letters follow, not figures, before returning to the first position. It has been seen that the letters of the semaphore alphabet are formed by the various angles at which the flags are held to the body, and, to send a message, we must stretch out the arms to their full extent, and hold the flags in a straight line with the arms, never allowing them to droop from the hands, and never inclining them to the rear. We may, however, turn on the hips, if we are about to form any letter which can be made more easily and seen more distinctly from a distance by doing so. We must be careful, when actually signaling, not to make the positions for the letters A and G too close to the body; and we must also remember, when making the letters T, O, and W, and the "numerical sign," to keep the two flags well separated from each other.



The flag alphabet shown in circles.

When signaling, the flags must be kept unfurled, and brought smartly and promptly from one letter position to another, the arms being brought right in to the body between each letter, and a pause must be made on the letter itself. A little longer pause should be made—the signaler standing with the flags crossed—between each word. The Army regulation speed for sending and receiving semaphore messages is at the rate of eight words a minute.

In order to receive a semaphore message in the correct military manner, two receivers are really required, one to take the actual message, and one to write down each letter as it is spoken by the taker.

It is the duty of whoever is the "writer-down" to say "No" should a word fail to make sense, when the receiver of the message will immediately stop the signaler by raising both arms horizontally to their full extent. The signaler will show that he has understood this by signaling back the sign J. The receiver —who should also be armed with two flags—will then send the last word which he received correctly, when the signaler will continue with his message from that word.

To make our knowledge of signaling complete, we should practise sending figures after we have become perfectly proficient in the *alphabet*.

It is most useful to be able to signal the time, and the signaling instructions say that the numeral sign will be used for the decimal point, and when sending time, to separate the hours and minutes; thus, for instance, 5.30 will be sent: Numeral sign, 5, numeral sign, 3, 0, alphabetical sign—the alphabetical sign being used to show that letters, not figures, will follow from this point.

The semaphore code, by the way, makes a splendid schoolroom cypher, while to the uninitiated a letter looks like nothing except a row of more or less meaningless scratches, of which no sense can be made.

MAKING A SIMPLE TELESCOPE

IT is possible to make a telescope, out of cardboard, that will show the mountains and dead volcanoes in the moon, of which we have all read. With this telescope we shall be able to see the moon so clearly that it will seem quite close, and we shall find it a fascinating world to watch. When it is "new" we can see the great mountains just catching the sunlight on their tops, and then, night after night, we may see the sunlight creeping towards more and more mountains, and flooding them with white light until the whole beautiful surface is bright and glowing.

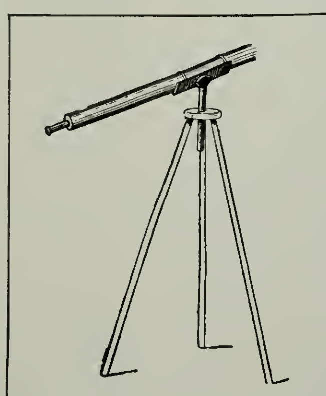
Now, a simple telescope is merely a long tube with a glass lens at each end. It does not matter what the tube is made of. We are going to make ours out of sheets of brown paper, which will be stuck together until we have formed stiff cardboard. First we must find a piece of curtain-pole, about two inches thick and about three feet long. We are going to wrap our brown paper round this so as to make a tube.

1. The cardboard telescope.

A. Cardboard tube. B. Piece of curtain-pole. C. Small cardboard tube for eye-piece. D. Eye-piece. E. Object lens. F. Cardboard support for lens.

When we have got this curtain-pole, and three or four large sheets of good brown paper that can be bought at any stationer's, we are ready to begin. We lay the paper out on a table and make it slightly damp with a sponge. It must not be made really wet, but only just damp enough for all the creases to come out. Now we make some glue with plenty of water. It should not be any thicker than the ordinary mucilage.

When this is ready, we take one sheet of the brown paper and wrap it once round the curtain-pole. Then, holding it so that it cannot slip, we spread some glue on the paper with a big brush and roll it round the pole bit by bit, until all the paper covered with glue has been rolled up. One or two more sheets should be stuck over the first in the same way; and then the pole, with the thick coat of paper round it, must be put away to dry.



2. The cardboard telescope complete on tripod stand made of three broomsticks.

Next morning we shall find that we can pull the curtain-pole out of the paper, and then we shall have a long tube of strong and thick cardboard that will look very neat and smooth, because the paper has shrunk a little in drying, and so there are no creases. The glue will have made it almost as hard as wood.

Now we must go to an optician's shop and buy the lenses. Of course, telescope lenses are made in all sizes, and we must explain exactly what we want. We shall need two, one big one, and one little one for the eye-piece.

These magnify enough for us to see some of the larger features of the moon; but, if we want to see more, then we must pay more money for the lenses. Very strong ones, that would show all the mountains and valleys splendidly, can be bought, if desired.

The optician will tell us "the focus" of the lens we buy. If he says it is 30 inches, he means that the cardboard tube we have made must be cut to 30 inches in length. If the lens is 24 inches focus, then our tube must be only 24 inches long.

When we have bought the lenses we must fit them into the tube with cardboard. First, we take the big one. Perhaps we shall find that it exactly fits into our two-inch tube; but if it should be a little too small, we must line one end of the tube with more brown paper until it fits. Now we cut two strips of thick cardboard about one inch wide, and just long enough to go once round the inside of the tube. One of these little hoops of cardboard must be glued into the tube about three inches from the end. When that has stuck nicely, the lens is put in so that it rests against the edges of the cardboard hoop.

The other strip of cardboard must now be wound round inside the tube, and pressed against the lens. This will hold the glass in position. It should not be glued in, as sometimes it is necessary to take the lens out to clean it. Now we must make a smaller tube for the eye-piece at the other end. This small tube is made exactly like the big one; but this time we shall wrap our brown paper round a stick that is just as thick as the diameter of the eye-piece. When the tube is made, the eye-piece is fixed in, like the big lens, with cardboard, but closer to the end of the tube. Then we cut a round piece of wood the size of a half-dollar, and drill a very small hole in the centre. This is to be glued at the end of the tube, as shown in the illustration. Now we have only to fix the small tube and the big tube together. We saw off a piece of the curtain-pole, about one inch and a half long. Then, with a brace and a centre-bit, or an augur-bit, we must bore a hole large enough for the small tube to slide through. Then the piece of curtain-pole is glued in the big tube, the little tube is put in the hole, and our telescope is ready.

When night comes we can point it at the moon. At first we shall see nothing but a blur of light; but if we draw the small tube backwards or forwards very gently, we shall find the correct position, and then, suddenly, we shall see the mountains of the moon.

A tripod stand, exactly like the one shown in the illustration, can be made out of three broomsticks very easily, and this will hold the telescope quite steady in any position.

A LITTLE VEGETABLE GARDEN

WHAT TO DO IN THE MIDDLE OF JULY

JULY is the least busy month in the summer, although we may still plant out our young vegetables, such as cabbages, cauliflowers, and celery. Last month we spoke of strawberry runners; all that are not required for future plants should be cut off as they appear. A good watering may be given to the raspberry canes, should the weather be hot and dry, and especially if no mulch has been given them. A mulch, of course, is a top dressing, consisting of stable manure, mown grass, or even soil, and it helps to keep the soil moist. Raspberries are thirsty things when the fruit is forming, so that, in dry weather, either the mulch or plentiful watering is helpful.

There is something we may do for the rhubarb during the summer. We may remove the great white flower, and cut down the stem that bears it. The flower takes to itself far too much of the health and strength of the plant; in fact, we need not wait until it has grown up and expanded, but may cut it out while still close to the ground.

We must give our celery plants good supplies of water during hot, dry weather, if the soil is very light and parched, though on heavier soil, one that retains the moisture, it will not be so necessary. In its native haunts the celery is a semi-aquatic—that is to say, a water-loving plant, growing close beside water —a true aquatic, of course, grows *in* the water. It is always well to find out all we can about plants in which we are interested, and to know that the celery is a semi-aquatic is quite enough to tell us it should never be allowed to lack water.

It has been mentioned a good many times that it is a good plan to keep the soil loose between the plants of growing crops, and with a hoe and a little fork, we should stir up the surface for a couple of inches or so.

Of course, the gardener has many enemies: our plants may be attacked by disease, or they may be destroyed, or partially destroyed, by insect pests. There are caterpillars, slugs, and wireworms, to mention but a few. Soot is generally distasteful to these, and, if the insects abound, it should be used freely. Sometimes, for instance, a gooseberry bush will have its leaves terribly destroyed by the gooseberry caterpillar, and for this dry lime, to sprinkle over the bushes, is recommended. We must not look upon worms as enemies, for they are of the greatest use in the soil; they work their way about in it, and are continually bringing up soil from a depth to the surface, thus acting as Nature's tillers of the soil in helping to keep it porous.

We have spoken of disease. Let us say a word about one that must be familiar to us all—mildew. Among other things, this may be caused by too much moisture. An effective remedy is five cents worth of powdered sulphur, mixed with an equal quantity of dry lime, sprinkled well over the affected part. Roses are very liable to mildew, especially where they are rather closely enclosed and cannot get enough light and air.

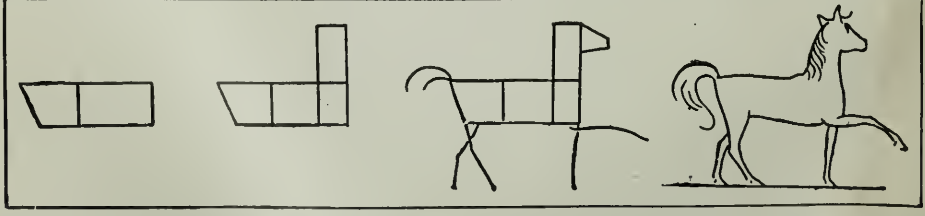
We must take great care of our dahlias at this stage of their growth, which means that we must stake them as soon as they require it, tie them to the stake, and then, as they grow taller, tie them yet again—of course, higher up. They must be made quite firm, or a sudden storm of wind and heavy rain may work havoc among them, as the stems are so exceedingly brittle. We shall do well to thin out the shoots, and if earwigs prove troublesome, we may place a flower-pot inverted upon the stake, after having put into it a little wisp of hay, or dry grass, or even paper or shavings, which serves as a trap.

All dead flowers, from all kinds of our plants, should be removed at once—as they fade, in fact—so as to prevent seed forming, for this very quickly exhausts the plants.

If we have a little collection of pot plants, either window plants or plants that we keep in the greenhouse, there will, perhaps, be among them some of a woody nature, such as azaleas, genistas, fuchsias, coronillas, deutzias. Now, these all require to have their growths thoroughly ripened, if they are to flower well next season, and to ripen the growths they need as much air and sunshine as they can get. We ought to stand the pots on a layer of ashes out of doors in a sunny spot, and water as often as necessary. The azalea should be placed in a shady position.

A SIMPLE WAY OF DRAWING A SPIRITED HORSE

HERE is an example of the way in which we can draw a spirited horse with ease. On page 1097 of this book we read of the way in which we can draw other pictures of this kind. We begin by drawing the figure on the left, then we carefully add the other necessary lines and rub out with eraser all the lines that cut through the body, and our horse is complete.



THE NEXT THINGS TO MAKE AND THINGS TO DO BEGIN ON PAGE 3897.

A GREAT POEM OF BRITISH HEROISM

In the long and glorious story of British heroism there are few chapters to match in thrilling interest the defence of Lucknow. When an immense number of the native soldiers in India rebelled against the British rule, and began that short but fierce struggle with their white masters known as the Indian Mutiny, the town of Lucknow was besieged by a great army of rebel soldiers. Within its walls Sir Henry Lawrence commanded a small force of British and loyal native soldiers, while as many more men, women, and children were there to be protected. For three terrible months the British held out against their swarming enemies, until Havelock and Outram came to their relief, on September 25, 1857. This historic episode in British history was fittingly celebrated in the following fine poem by Lord Tennyson.

THE DEFENCE OF LUCKNOW

CONTINUED FROM 3703

Banner of England, not for a season, O banner of Britain, hast thou
Floated in conquering battle or flapt to the battle-cry!
Never with mightier glory than when we had reared thee on high,
Flying at top of the roofs in the ghastly siege at Lucknow—
Shot through the staff or the halyard, but ever we raised thee anew,
And ever upon the topmost roof our banner of England blew.

Frail were the works that defended the hold that we held with our lives—
Women and children among us, God help them, our children and wives!
Hold it we might—and for fifteen days or for twenty at most.
"Never surrender, I charge you, but every man die at his post!"
Voice of the dead whom we loved, our Lawrence, the best of the brave:
Cold were his brows when we kissed him—we laid him that night in his grave.
"Every man die at his post!" and there hailed on our houses and halls
Death from their rifle-bullets, and death from their cannon-balls,
Death in our innermost chamber, and death at our slight barricade,
Death while we stood with the musket, and death while we stoopt to the spade,
Death to the dying, and wounds to the wounded, for often there fell,
Striking the hospital wall, crashing through it, their shot and their shell.
Death—for their spies were among us, their marksmen were told of our best,
So that the brute bullet broke through the brain that could think for the rest;
Bullets would sing by our foreheads, and bullets would rain at our feet—
Fire from ten thousand at once of the rebels that girdled us round;
Death at the glimpse of a finger from over the breadth of a street,
Death from the heights of the mosque and the palace, and death in the ground!
Mine? yes, a mine! countermine! down, down! and creep through the hole!
Keep the revolver in hand! You can hear him—the murderous mole.
Quiet, ah! quiet—wait till the point of the pickaxe be through!
Click with the pick, coming nearer and nearer again than before—
Now let it speak, and you fire, and the dark pioneer is no more;
And ever upon the topmost roof our banner of England blew.

Ay, but the foe sprung his mine many times, and it chanced on a day,
Soon as the blast of that underground thunder-clap echoed away,
Dark through the smoke and the sulphur, like so many fiends in their hell—
Cannon-shot, musket-shot, volley on volley, and yell upon yell—
Fiercely on all the defences our myriad enemies fell.
What have they done? Where is it? Out yonder. Guard the Redan!
Storm at the Water-gate! storm at the Bailey gate! storm, and it ran
Surging and swaying all round us, as ocean on every side
Plunges and heaves at a bank that is daily drowned by the tide—
So many thousands that if they be bold enough, who shall escape?
Kill or be killed, live or die, they shall know we are soldiers and men!
Ready! take aim at their leaders—their masses are gapped with our grape—
Backward they reel like the wave, like the wave flinging forward again,
Flying and foiled at the last by the handful they could not subdue;
And ever upon the topmost roof our banner of England blew.

Handful of men as we were, we were English in heart and in limb.
Strong with the strength of the race to command, to obey, to endure,
Each of us fought as if hope for the garrison hung but on him;
Still—could we watch at all points? we were every day fewer and fewer.
There was a whisper among us, but only a whisper that passed:

"Children and wives—if the tigers leap into the fold unawares—
Every man die at his post—and the foe may outlive us at last—
Better to fall by the hands that they love, than to fall into theirs!"
Roar upon roar in a moment two mines, by the enemy sprung,
Clove into perilous chasms our walls and our poor palisades.
Rifleman, true is your heart, but be sure that your hand be as true!
Sharp is the fire of assault, better aimed are your flank fusillades—
Twice do we hurl them to earth from the ladders to which they had clung,
Twice from the ditch where they shelter, we drive them with hand grenades;
And ever upon the topmost roof our banner of England blew.

Then on another wild morning another wild earthquake out-tore
Clean from our lines of defence ten or twelve good paces or more.
Rifleman, high on the roof, hidden there from the light of the sun—
One has leapt up on the breach, crying out, 'Follow me! Follow me!"—
Mark him—he falls! Then another, and *him* too, and down goes he.
Had they been bold enough then, who can tell but the traitors had won?
Boardings, and raftings, and doors—an embrasure! Make way for the gun!
Now double charge it with grape! It is charged and we fire, and they run.
Praise to our Indian brothers, and let the dark face have his due!
Thanks to the kindly dark faces who fought with us, faithful and few,
Fought with the bravest among us, and drove them, and smote them and slew—
That ever upon the topmost roof our banner in India blew.

Men will forget what we suffer and not what we do. We can fight;
But to be soldier all day and be sentinel all through the night—
Ever the mine and assault, our sallies, their lying alarms;
Bugles and drums in the darkness, and shoutings and soundings to arms,
Ever the labour of fifty that had to be done by five,
Ever the marvel among us that one should be left alive,
Ever the day with its traitorous death from the loopholes around,
Ever the night with its coffinless corpse to be laid in the ground,
Heat like the mouth of a hell, or a deluge of cataract skies,
Stench of old offal decaying, and infinite torment of flies,
Thoughts of the breezes of May blowing over an English field,
Cholera, scurvy, and fever, the wound that would not be healed,
Lopping away of the limb by the pitiful-pitiless knife—
Torture and trouble in vain—for it never could save us a life,
Valour of delicate women who tended the hospital bed,
Horror of women in travail among the dying and dead,
Grief for our perishing children, and never a moment for grief,
Toil and ineffable weariness, faltering hopes of relief,
Havelock baffled or beaten, or butchered, for all that we knew—
Then day and night, day and night, coming down on the still shattered walls
Millions of musket-bullets, and thousands of cannon-balls—
But ever upon the topmost roof our banner of England blew.

Hark! cannonade, fusillade! is it true what was told by the scout,
Outram and Havelock breaking their way through the fell mutineers?
Surely the pibroch of Europe is ringing again in our ears!
All on a sudden the garrison utter a jubilant shout,
Havelock's glorious Highlanders answer with conquering cheers,
Forth from their holes and their hidings our women and children come out,
Blessing the wholesome white faces of Havelock's good fusileers,
Kissing the war-hardened hand of the Highlander wet with their tears!
Dance to the pibroch! saved! we are saved! is it you? is it you?
Saved by the valour of Havelock, saved by the blessing of Heaven!
"Hold it for fifteen days!" we have held it for eighty-seven!
And ever aloft on the palace roof the old banner of England blew.

DEATH

This great sonnet by Dr. John Donne, who was appointed Dean of St. Paul's Cathedral in 1621, may be considered in the light of the Apostle Paul's triumphant exclamation, "O Death, where is thy sting? O Grave, where is thy victory?" Death, so far from being the conqueror, will itself be laid low. How foolish of Death, then, thus the poet argues, to "swell" or pride itself upon its powers, as its strength is but an empty boast. Death itself shall die for it is only the gateway to real life, the Life Eternal.

DEATH, be not proud, though some have callèd thee
Mighty and dreadful, for thou art not so;
For those whom thou thinkest thou dost overthrow
Die not, poor Death; nor yet canst thou kill me.
From Rest and Sleep, which but thy picture be,
Much pleasure, then from thee much more must flow;
And soonest our best men with thee do go—
Rest of their bones and souls' delivery!
Thou'rt slave to fate, chance, kings, and desperate men,
And dost with poison, war, and sickness dwell;
And poppy or charms can make us sleep as well
And better than thy stroke. Why swell'st thou, then?
One short sleep past, we wake eternally,
And Death shall be no more. Death, thou shalt die!

SALLY IN OUR ALLEY

Few songs are better known or more popular than this, supposed to be sung by the apprentice who loves his pretty Sally so dearly, although she *does* live in a humble alley. He will be true to her, too, in spite of the disagreeable neighbors, who "make game" of him and his sweetheart. Of course, Sunday is "the day that comes between a Saturday and Monday." Henry Carey, the author of this song, who died in 1743, was also a musician of some note in his day. It has been said that he wrote the English National Anthem, but the evidence in his favor is not very strong.

OF all the girls that are so smart,
There's none like pretty Sally;
She is the darling of my heart,
And lives in our alley:
There is no lady in the land
That's half so sweet as Sally;
She is the darling of my heart,
And lives in our alley.

Of all the days within the week
I dearly love but one day,
And that's the day that comes between
A Saturday and Monday:
Oh! then I'm dress'd in all my best,
To walk abroad with Sally;
She is the darling of my heart,
And lives in our alley.

When Christmas comes about again,
Oh! then I shall have money;
I'll save it up, and box and all
I'll give unto my honey;
And when my seven long years are out,
Oh! then I'll marry Sally,
And then how happily we'll live!
But not in our alley.

TO ANTHEA, WHO MAY COMMAND HIM ANYTHING

In 1674 two great English poets died—John Milton and Robert Herrick. Though the former is the more illustrious, Herrick is not unworthy to be mentioned with him. He attempted nothing on the grand scale, but in the whole realm of poetry there are few, if any, lyrics more exquisite than his. "To Anthea" is a superb example of the whole-hearted devotion of a gallant Cavalier to the lady of his love.

BID me to live, and I will live
Thy Protestant to be;
Or bid me love, and I will give
A loving heart to thee.

A heart as soft, a heart as kind,
A heart as sound and free
As in the whole world thou canst find,
That heart I'll give to thee.

Bid that heart stay, and it will stay,
To honour thy decree;
Or bid it languish quite away,
And't shall do so for thee.

Bid me to weep, and I will weep
While I have eyes to see:
And having none, yet I will keep
A heart to weep for thee.

Bid me despair, and I'll despair,
Under that cypress tree;
Or bid me die, and I will dare
E'en death, to die for thee.

Thou art my life, my love, my heart,
The very eyes of me,
And hast command of every part,
To live and die for thee.

JENNY KISS'D ME

Leigh Hunt, throughout all the ups and downs of his long and varied career—he died in 1859 in his seventy-fifth year—seems always to have been bright and cheery. His essays rank next to those of Charles Lamb, and, though sometimes sneered at as the leader of the "Cockney School" of poets, he wrote dainty verse with such a light and happy touch that these effusions, at all events, are sure of a permanent place in any collection of English poetry. In its way, nothing could be better than the following stanza.

JENNY kiss'd me when we met,
Jumping from the chair she sat in;
Time, you thief, you love to get
Sweets into your list, put that in!
Say I'm weary, say I'm sad,
Say that health and wealth have miss'd me,
Say I'm growing old, but add,
Jenny kiss'd me.

DAYBREAK

Longfellow at his best was a people's true poet, and that is the secret of his universal popularity. He is not the poet of this country or of that, but of all countries where English is read. Moreover, he is the poet of the young as well as of the old, of woman as well as of man—the poet of the home. This great popularity he owes to his gift of sweet song, to his power of expressing his thoughts in clear language, to his absence of conceit and mannerism, to his complete wholesomeness and sanity. The various aspects of the dawn are beautifully displayed in the accompanying lines.

A WIND came up out of the sea,
And said: 'O mists, make room for me."

It hailed the ships, and cried: "Sail on,
Ye mariners, the night is gone."

And hurried landward far away,
Crying: "Awake! It is the day."

It said unto the forest: "Shout!
Hang all your leafy banners out!"

It touched the wood-bird's folded wing,
And said: "O bird, awake and sing!"

And o'er the farms: "O chanticleer,
Your clarion blow; the day is near."

It whispered to the fields of corn:
"Bow down, and hail the coming morn."

It shouted through the belfry tower:
"Awake, O bell, proclaim the hour!"

It crossed the churchyard with a sigh,
And said: "Not yet; in quiet lie."

THE BARGAIN

This beautiful little poem by Sir Philip Sidney, who died so heroically at Zutphen in 1586, is a choice illustration of the fanciful conceits of which English poets of the period were so fond. It is a pretty comment on the proverb that "A fair exchange is no robbery." By his prose romance of "Arcadia" Sir Philip became one of the earliest novel-writers.

MY true love hath my heart, and I have his,
By just exchange one for another given;
I hold his dear, and mine he cannot miss,
There never was a better bargain driven:
My true love hath my heart, and I have his.

His heart in me keeps him and me in one,
My heart in him his thoughts and senses guides;
He loves my heart, for once it was his own,
I cherish his because in me it bides;
My true love hath my heart, and I have his.

LATE LEAVES

Poets often find a source of inspiration in the seasons of the year. To Walter Savage Landor the fall of the leaf has brought, in these verses, a sense of profound melancholy. No doubt the deep sadness they express corresponded with his own experiences. He had gone through a prolonged autumn in his own life, for he was eighty-nine years old when he died, in 1864. The passing of old friends was typified for him in the dying flowers and the dropping leaves; and the reunion with them was symbolized by the return of spring.

THE leaves are falling; so am I;
The few late flowers have moisture in the
So have I, too. [eye;
Scarcely on any bough is heard
Joyous, or even unjoyous, bird
The whole wood through.

Winter may come. He brings but nigher
His circle (yearly narrowing) to the fire
Where old friends meet.
Let him; now heaven is overcast,
And spring and summer both are past,
And all things sweet.

THE OLD CLOAK

It is a bitter night in winter. Bell, the farmer's wife, cannot sleep for thinking of poor old Crummie, the cow, that has been such a good friend to her and her family. So she urges the farmer to get up to save "Crumbock's" life. But the goodman does not relish the prospect of leaving his warm bed to go out into the blast, and pleads that his cloak is too worn to be of use to him in such weather. He must have a new cloak, he declares. But his wife sticks to her point bravely, and at last he takes his old cloak about him, and sets out to save the cow. This subject is worked out, in dialogue form, in the fine old Scottish ballad here given, and is also, it may be added, to be found in the popular song "Tak' your auld cloak aboot ye." A few words call for explanation. "Boreas" is the north wind; "to spill" here means to perish; "flyte" is to scold; "cricke," cricket; "renne," run (the suggestion being that the coat is so dreadfully thin and threadbare that it won't bear the weight of a cricket); "ken," know; "lown," dunce, rascal; "threap," argue with some degree of bitterness.

THIS winter's weather it waxeth cold,
And frost it freezeth on every hill,
And Boreas blows his blast so bold
That all our cattle are like to spill.
Bell, my wife, she loves no strife;
She said unto me quietlye:
'Rise up, and save cow Crumbock's life!
Man, put thine old cloak about thee!"

HE

O Bell, my wife, why dost thou flyte?
Thou kens my cloak is very thin
It is so bare and over-worn,
A crické thereon cannot renne.
Then I'll no longer borrow nor lend;
For once I'll new apparell'd be.
To-morrow I'll to town and spend.
For I'll have a new cloak about me.

SHE

Cow Crumbock is a very good cow;
She has been always true to the pail;
She has helped us to butter and cheese, I trow;
And other things she will not fail.
I would be loth to see her pine,
Good husband, counsel take of me:
It is not for us to go so fine—
Man, take thine old cloak about thee!

HE

My cloak it was a very good cloak,
It hath been always true to the wear;
But now it is not worth a groat—
I have had it four-and-forty year.
Some time it was of cloth in grain,
'Tis now but a sigh clout, as you may see;
It will neither hold out wind nor rain,
And I'll have a new cloak about me.

SHE

It is four-and-forty years ago
Sine the one of us the other did ken;
And we have had, betwixt us two,
Of children either nine or ten.
We have brought them up to women and men,
In the fear of God I trow they be
And why wilt thou thyself misken?
Man, take thine old cloak about thee!

HE

O Bell, my wife, why dost thou flyte?
Now is now, and then was then.
Seek now all the world throughout,
Thou kens not clowns from gentlemen.
They are clad in black, green, yellow, and blue,
So far above their own degree.
Once in my life I'll take a view,
For I'll have a new cloak about me.

SHE

King Stephen was a worthy peer;
His breeches cost him but a crown;
He held them sixpence all too dear,
Therefore he called the tailor "lown."
He was a king and wore the crown,
And thou'se but of a low degree.
It's pride that puts this country down—
Man, take thy old cloak about thee!

HE

Bell, my wife, she loves not strife,
Yet she will lead me, if she can;
And to maintain an easy life
I oft must yield, though I'm goodman.
It's not for a man with a woman to threap,
Unless he first give o'er the plea:
As we began, so will we keep,
And I'll take my old cloak about me.

OFT IN THE STILLY NIGHT

Thomas Moore (born, 1779; died, 1852) did for the delightful Irish airs, or tunes, what Robert Burns did for so many of those of Scotland—that is, he wrote suitable words for them. The present is a much-admired example of the poet's work. Its theme is very simple. In the quiet of night, ere falling to sleep, the singer's memory brings back to him the light of other days, even the years of his long-past happy boyhood.

OFT in the stilly night,
Ere Slumber's chain has bound me,
Fond Memory brings the light
Of other days around me:
The smiles, the tears, of boyhood's years;
The words of love then spoken;
The eyes that shone—
Now dimm'd and gone;
The cheerful hearts—now broken! . . .
Thus, in the stilly night,
Ere Slumber's chain hath bound me,
Sad Memory brings the light
Of other days around me.

When I remember all
The friends, so link'd together,
I've seen, around me fall,
Like leaves in wintry weather,
I feel like one who treads alone
Some banquet-hall deserted—
Whose lights are fled,
Whose garland's dead,
And all but he departed! . . .
Thus, in the stilly night,
Ere Slumber's chain has bound me
Sad Memory brings the light
Of other days around me.

JOHN ANDERSON

This well-known song is a love-song—with a difference. In it Robert Burns pictures a happy couple not at the beginning of their married life, but towards its close; and it says much for the enduring affection each has cherished for the other that the old lady is able to sing so tenderly of her "jo," or sweetheart. The Scots words in the song are easy to understand, but "brent," it may be said, means smooth, or unwrinkled; "pow," head, and "canty," happy.

JOHN ANDERSON, my jo, John,
When we were first acquent,
Your locks were like the raven,
Your bonnie brow was brent;
But now your brow is bald, John,
Your locks are like the snow;
But blessings on your frosty pow,
John Anderson, my jo.

John Anderson, my jo, John,
We clamb the hill thegither,
And mony a canty day, John,
We've had wi' ane anither;
Now we maun totter down, John;
But hand in hand we'll go,
And sleep thegither at the foot,
John Anderson, my jo.

SILVIA

It has been said that when a character in one of Shakespeare's plays "favored" the audience with a song, this happened when the company contained a man who was both an actor and singer. Though these songs were not numerous, they were perfect examples of the divine art; and one of the most charming is that here quoted. It occurs in "The Two Gentlemen of Verona," and has been set to music worthy of it by the famous German composer Schubert.

WHO is Silvia? What is she,
That all our swains commend her?
Holy, fair, and wise is she;
The Heaven such grace did lend her,
That she might admired be.

Is she kind as she is fair?
For beauty lives with kindness:
Love doth to her eyes repair,
To help him of his blindness;
And being help'd, inhabits there.

Then to Silvia let us sing,
That Silvia is excelling;
She excels each mortal thing
Upon the dull earth dwelling;
To her let us garlands bring.

THE SHEPHERD BOY SINGS IN THE VALLEY OF HUMILIATION

John Bunyan, whose "Pilgrim's Progress" is the greatest allegory in the world, wrote very little verse. But the snatches of poetry he introduced here and there into his story were quaintly expressed. The song which he placed in the mouth of the Shepherd Boy in the Vall y of Humiliation, however, is entitled to the highest praise, even on the literary side. The lad had already found out the secret of true happiness and peace. A contented mind is a continual feast.

HE that is down needs fear no fall,
He that is low no pride;
He that is humble ever shall
Have God to be his guide.

I am content with what I have,
Little be it or much;
And, Lord, contentment still I crave,
Because Thou savest such.

Fulness to such a burden is
That go on pilgrimage;
Here little, and hereafter bliss,
Is best from age to age.

THE VOICE OF TOIL

William Morris, born 1834, died 1896, was famous as a poet, as a writer of romance, and a lover of the fine arts. His sympathy with the poor and oppressed in the battle of life was so deep and abiding, that much of his writting is devoted to advocating the cause of the workers. The following poem is, in a way, a battle-cry to do service on behalf of the poor.

I HEARD men saying: Leave hope and praying,
All days shall be as all have been;
To-day and to-morrow bring fear and sorrow,
The never-ending toil between.

When earth was younger, mid toil and hunger,
In hope we strove, and our hands were strong;
Then great men led us, with words they fed us,
And bade us right the earthly wrong.

Go read in story their deeds and glory,
Their names amidst the nameless dead;
Turn them from lying to us slow-dying
In that good world to which they led;

Where fast and faster our iron master,
The thing we made, for ever drives,
Bids us grind treasure and fashion pleasure
For other hopes and other lives.

Where home is a hovel and dull we grovel,
Forgetting that the world is fair;
Where no babe we cherish, lest its very soul perish;
Where mirth is crime, and love a snare.

Who now shall lead us, what god shall heed us,
As we lie in the hell our hands have won?
For us are no rulers, but fools and befoolers,
The great are fallen, the wise men gone.

I heard men saying: Leave tears and praying,
The sharp knife heedeth not the sheep.
Are we not stronger than the rich and the wronger,
When day breaks over dreams and sleep?

Come, shoulder to shoulder, ere the world grows older!
Help lies in nought but thee and me;
Hope is before us, and the long years that bore us
Bore leaders more than men may be.

Let dead hearts tarry, and trade and marry,
And trembling nurse their dreams of mirth;
While we the living our lives are giving
To bring the bright new world to birth.

Come, shoulder to shoulder, ere earth grow older!
The Cause spreads over land and sea;
Now the world shaketh, and fear awaketh,
And joy at last for thee and me.

THE CONCLUSION

Sir Walter Raleigh was accused of treason and imprisoned in the Tower, where he was beheaded in 1618. While lying in prison he wrote a "History of the World." He also wrote several poems, of which we give here a short specimen, the melancholy tone of which points to its having been composed within the shadow of death. But Sir Walter's high courage does not desert him, and his faith in God is supreme.

EVEN such is time, that takes in trust
Our youth, our joys, our all we have,
And pays us but with earth and dust;
Who in the dark and silent grave,
When we have wander'd all our ways,
Shuts up the story of our days;
But from this earth, this grave, this dust,
My God shall raise me up, I trust.

THE LAST MAN

In this famous poem, Thomas Campbell presents, with fine dramatic effect, a picture of the earthly end of the human race. It is a pure effort of the imagination, and is not given as a serious suggestion of how life will die away on this planet. Its real value is to illustrate how indestructible is man's faith in the future life, to which our existence here is only the first chapter of a story that goes on for ever.

ALL worldly shapes shall melt in gloom,
The Sun himself must die,
Before this mortal shall assume
Its Immortality!
I saw a vision in my sleep.
That gave my spirit strength to sweep
Adown the gulf of Time!
I saw the last of human mould
That shall Creation's death behold,
As Adam saw her prime!

The Sun's eye had a sickly glare,
The Earth with age was wan,
The skeletons of nations were
Around that lonely man!
Some had expired in fight—the brands
Still rusted in their bony hands;
In plague and famine some!
Earth's cities had no sound nor tread;
And ships were drifting with the dead
To shores where all was dumb!

Yet, prophet-like, that lone one stood
With dauntless words and high,
That shook the sere leaves from the wood
As if a storm passed by,
Saying, We are twins in death, proud Sun!
Thy face is cold, thy race is run,
'Tis Mercy bids thee go;
For thou ten thousand thousand years
Hast seen the tide of human tears,
That shall no longer flow.

What though beneath thee man put forth
His pomp, his pride, his skill;
And arts that made fire, flood, and earth
The vassals of his will!
Yet mourn I not thy parted sway,
Thou dim discrowned king of day:
For all those trophied arts
And triumphs that beneath thee sprang
Heal'd not a passion or a pang
Entail'd on human hearts.

Go, let Oblivion's curtain fall
Upon the stage of men,
Nor with thy rising beams recall
Life's tragedy again:
Its piteous pageants bring not back,
Nor waken flesh, upon the rack
Of pain anew to writhe;
Stretch'd in disease's shapes abhorr'd
Or mown in battle by the sword,
Like grass beneath the scythe.

Ev'n I am weary in yon skies
To watch thy fading fire;
Test of all sumless agonies,
Behold not me expire.
My lips that speak thy dirge of death—
Their rounded gasp and gurgling breath
To see thou shalt not boast.
The eclipse of Nature spreads my pall—
The majesty of Darkness shall
Receive my parting ghost!

This spirit shall return to Him
Who gave its heavenly spark;
Yet think not, Sun, it shall be dim
When thou thyself art dark!
No! it shall live again, and shine
In bliss unknown to beams of thine,
By Him recall'd to breath,
Who captive led Captivity,
Who robb'd the grave of Victory—
And took the sting from Death!

Go, Sun, while Mercy holds me up
On Nature's awful waste
To drink this last and bitter cup
Of grief that man shall taste—
Go, tell the Night that hides thy face
Thou saw'st the last of Adam's race,
On Earth's sepulchral clod,
The darkening universe defy
To quench his Immortality,
Or shake his trust in God!

THE SOWER

In the fables of old Greece there is a story of a Phœnician prince named Cadmus, who, attacking a dragon, succeeded in killing it. Taking out the teeth of the dragon, he sowed them in a plain, upon which armed men suddenly arose from the ground, and when he threw a stone among them they instantly began to fight each other, and so continued till all were killed except five, who helped Cadmus to build his city. The old legend is used by modern poets when they wish to suggest the origin of strife and anarchy, as in the following poem written by James Russell Lowell.

I SAW a sower walking slow
Across the earth, from east to west.
His hair was white as mountain snow,
His head drooped forward on his breast.

With shrivelled hands he flung his seed,
Nor ever turned to look behind;
Of sight or sound he took no heed;
It seemed he was both deaf and blind.

His dim face showed no soul beneath,
Yet in my heart I felt a stir,
As if I looked upon the sheath
That once had held Excalibur.

I heard, as still the seed he cast,
How, crooning to himself, he sung:
"I sow again the holy past,
The happy days when I was young.

"Then all was wheat without a tare,
Then all was righteous, fair, and true;
And I am he whose thoughtful care
Shall plant the Old World in the New.

"The fruitful germs I scatter free,
With busy hand, while all men sleep;
In Europe now, from sea to sea,
The nations bless me as they reap."

Then I looked back along his path,
And heard the clash of steel on steel,
Where man faced man, in deadly wrath,
While clanged the tocsin's hurrying peal.

The sky with burning towns flared red,
Nearer the noise of fighting rolled,
And brother's blood, by brothers shed,
Crept curdling over pavements cold.

Then marked I how each germ of truth,
Which through the dotard's fingers ran,
Was mated with a dragon's tooth,
Whence there sprang up an armèd man.

I shouted, but he could not hear;
Made signs, but these he could not see;
And still, without a doubt or fear,
Broadcast he scattered anarchy.

Long to my straining ears the blast
Brought faintly back the words he sung:
"I sow again the holy past,
The happy days when I was young."

CHILD AND MOTHER

O Mother-My-Love, if you'll give me your
hand,
And go where I ask you to wander,
I will lead you away to a beautiful land—
The Dreamland that's waiting out yonder.
We'll walk in the sweet posie garden out there,
Where moonlight and starlight are streaming,
And the flowers and the birds are filling the air
With the fragrance and music of dreaming.

There'll be no little tired-out boy to undress,
No questions or cares to perplex you;
There'll be no little bruises or bumps to caress,
Nor patching of stockings to vex you.
For I'll rock you away on a silver-dew stream,
And sing you to sleep when you're weary;
And no one shall know of our beautiful dream
But you and your own little dearie.

And when I am tired I'll nestle my head
In the bosom that's soothed me so often;
And the wide-awake stars shall sing in my
stead
A song which our dreaming shall soften.
So, Mother-My-Love, let me take your dear
hand,
And away through the starlight we'll wander,
Away through the mist to the beautiful land—
The Dreamland that's waiting out yonder.

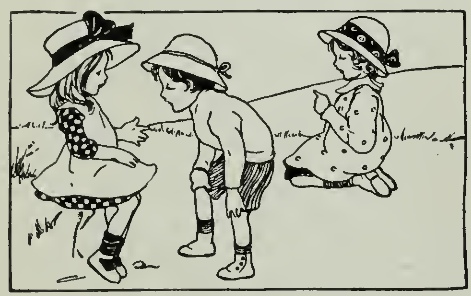
LITTLE VERSES FOR VERY LITTLE PEOPLE

LITTLE Robin Redbreast sat upon a
 tree;
Up went pussy cat and down went he.
Down came pussy cat, and away Robin
 ran;
Says little Robin Redbreast: "Catch
 me if you can."

A, B, C, tumble down D,
 The cat's in the cupboard
And can't see me.

BYE, oh, my baby,
 When I was a lady,
Oh, then my poor babe didn't cry.
 But now he is weeping
 For want of good keeping,
And I fear my poor baby will die.

OF all the gay birds that e'er I did see,
 The owl is the fairest by far to me;
For all day long he sits on a tree,
And when the night comes away flies he.



A GIFT on the finger
 Is sure to linger;
A gift on the thumb
Is sure to come!

'TWAS once upon a time,
 When Jenny Wren was young,
So daintily she danced,
 So prettily she sung.

Robin Redbreast lost his heart,
 For he was a gallant bird.
So he doffed his hat to Jenny,
 Requesting to be heard.

Cock Robin got up early,
 Just at the break of day,
And went to Jenny's window
 To sing a roundelay.

He sang Cock Robin's love
 To the pretty Jenny Wren;
And when he got unto the end,
 Then he began again!

FIRST the farmer sows his seeds,
 Then he stands and takes his ease;
Stamps his foot and claps his hands,
And turns him round to view his lands.

TWO little dogs were basking in the
 cinders,
Two little cats were playing in the
 windows,
When two little mice popped out of a
 hole,
And up to a fine piece of cheese they
 stole.
The two little dogs cried: "Cheese is
 nice!"
But the two little cats jumped down in
 a trice,
And soon cracked the bones of the two
 little mice.

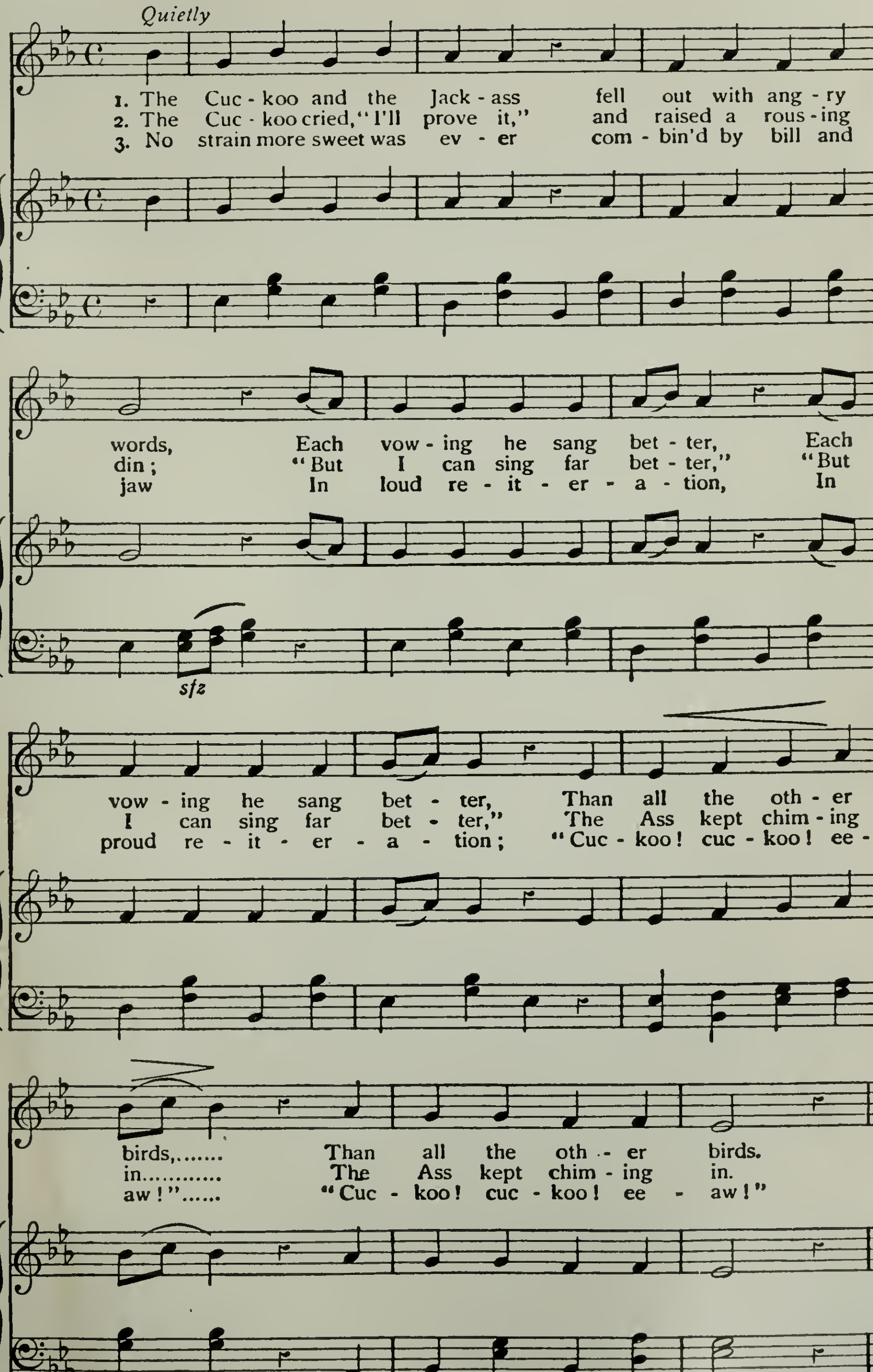
AS I went over the water, the water
 went over me;
I saw two little blackbirds sitting on a
 tree.
The one called me a rascal, the other
 called me a thief;
I took my blackthorn stick, and knocked
 out all their teeth.

PUSSY cat ate the dumplings
 Pussy cat ate the dumplings!

Mamma stood by, and cried, "Oh, fie!
Why did you eat the dumplings?"

THE CUCKOO AND THE JACKASS

Words by ALFRED P. GRAVES. Music by permission of MESSRS. SCHOTT & Co.



GREAT CITIES IN THE RUSSIAN LAND

Moscow is the ancient capital of the Russian Empire, Kiev is another ancient city, and Warsaw is the old capital of Poland. To the great fair at Nijni-Novgorod 400,000 traders bring $120,000,000 worth of goods.

RUSSIA IN RECENT TIMES

CONTINUED FROM 3729

ST PETER AND ST PAUL

RUSSIA before the World War included more than half of Europe, added to more than one-third of Asia, or about one-seventh part of all the world, and its climate varied from the temperate regions of southern Russia to the bitter cold of Arctic winters of the north.

Since the downfall of the imperial government and the rise of the Soviets, Russia has lost much territory and population in both Europe and Asia. We cannot yet know certainly what are to be the future boundaries of the state, and shall, therefore, leave the recent history to the end of our story and tell you first of Russia before 1918.

We have already seen how this great dominion grew through the centuries till it reached the White Sea, the Baltic Sea, and the Black Sea, and the Pacific, and was as large as Canada, Mexico and the United States together. Let us now, with our maps and pictures before us, try to gain some idea of these 8,500,000 square miles of the earth's surface; also, where and how the 180,000,000 people lived.

First, from the map we gather that there were vast districts in Russia unsuitable for people to live in. Round the shores of the frozen sea, and on the tundras, or dreary plains, where the winter is dark and long, and the summer is short and hot, very few people live. These few people wander about with herds of reindeer, as in the north of Scandinavia; or they fish, or hunt bears and foxes for their furs, and use sledges, drawn by teams of dogs, to travel over the ice and snow. South of the tundras are miles and miles of forests, spreading darkly farther than the eye can see.

Then, again, to the south of the empire there is a belt of land with very few people living upon it—a belt stretching from the north of the Black Sea and the Caspian Sea to the Sea of Aral, and onwards to the heights of Central Asia.

Where then shall we look for the people of these vast dominions? The majority of them are the peasants, who were serfs, or slaves, not many years ago, scattered over countless fields. These peasants, for the most part, lead dull, sad lives, and are terribly poor. Sometimes famines cause desperate starvation in the land that produces and sells to other countries great quantities of grain. The intense cold, too, also brings much suffering to the

poor, for all over Russia, except on the Black Sea Riviera, snow and ice last for months. Some used to go into the towns to work when nothing could be done in the fields; but, in most cases, the poor people paste up every cranny that lets in air to their wretched hovels, light a stove, which is kept going, if possible, night and day, and resign themselves to a sad existence, until spring comes to free them from the cold.

THE UNTOLD WEALTH THAT LIES BURIED UNDERGROUND IN RUSSIA

The mineral wealth of Russia is untold, and has not been half worked. There are iron, copper, gold, and silver among valuable metals; every variety of precious stones, marbles, and agates; and thousands of unhappy beings toil year after year, wresting these minerals from their dark hiding-places in Mother Earth's rich stores. Up to the year 1900, criminals and political prisoners, the latter of whom were sometimes only suspected of breaking the laws, were sent to Siberia as exiles or prisoners. Many were sent to work in the mines, and they generally suffered great hardships. Numbers of these people still live in Siberia, some of them in a sad state of poverty.

Others of Russia's millions were to be found by the waters that cover so much of its surface, working and building the steamers and the infinite variety of boats and barges on the rivers, canals, and lakes. Others have devoted themselves to fishing, for fish is extraordinarily plentiful, and is much needed, as there are so many fasts in the Eastern Church, when no flesh food, but only fish, is allowed to be eaten. Russia is not a great manufacturing country, although many iron, steel, copper, and textile works were growing up when the World War came. There are no districts densely peopled, with towns almost joining each other. But there are innumerable towns in Russia, most of them very interesting, chiefly situated on the old great river highways; and more were growing up along the vast new iron highways—the railways—that link up the north and south, and the east and west.

THE CITY OF PETER THE GREAT, THAT SEEMS TO FLOAT UPON THE WATERS

One of the chief routes from America to Petrograd, as St. Petersburg is now called, is *via* Berlin to Warsaw, and then northward to the capital. If we choose to go from Hamburg by sea, it will take a little longer, even if we shorten the journey by going through the Kiel Canal, instead of round Denmark to the Baltic, then up the Gulf of Finland, past Kronstadt, the great arsenal and sentinel of the Neva, to the city of Peter the Great, the capital of the empire, built on the islands and shores of the Neva, as it winds into the Gulf of Finland. On our way home, we may make the long railway journey across Siberia to Vladivostok, where we may find a steamer which will bring us across the Pacific, and so our trip to Russia will have taken us all the way round the globe.

If we mount the dome of St. Isaac's Cathedral, near the centre of Petrograd, and look down on the mass of glittering water in the canals and arms of the Neva, the city seems as if almost floating upon it. The edges are lined with quays and docks; barges and steamers and boats of all kinds used to ply in every direction, for Petrograd is connected by water with the distant Black, White, and Caspian seas. But if our visit is in winter, a different scene meets our eyes. All is frozen—the Gulf of Finland, the rivers, the canals, and the lakes.

THE SLEIGHS WITH THE TINKLING BELLS THAT RUSH OVER THE FROZEN LAKES

The ice is strong enough to bear carriages of every description. A few years ago one might see important folk, wrapped up to the eyes in warm furs, gliding swiftly along in sleighs, sometimes with three horses abreast, tinkling their bells, over the ice and snow, to enjoy all the balls and theatres and parties of the gay winter season. French is freely spoken by many people in Russia, as other Europeans find it very difficult to learn to speak the Russian language. Between St. Isaac's and the Neva is the statue of the founder of the city, with the English quay on one side and the Admiralty buildings on the other. From the Admiralty the three chief streets, or prospects, radiate in straight lines. The Nevski Prospect, like the Unter den Linden of Berlin, is one of the finest streets in Europe. The Kazan Cathedral is in it; and at its end is one of the most celebrated monasteries in Russia—that of St. Alexander Nevski.

In recent years since the Russian Revolution the seat of government has been transferred to Moscow, and Petrograd has lost both in importance and in population.

THE PEOPLE OF EUROPEAN RUSSIA

Here is a Russian gipsy girl. There are fewer gipsies in Russia than other countries.

These are peasant girls of Little Russia, or Ukraine, the part of Russia in Europe that includes the important town and province of Kiev.

This moujik, or peasant, girl belongs to the province of Tver, north of Moscow.

The mass of the people of Russia are very poor. Their despotic and selfish Government used to grind enormous sums from them in the way of taxes, a large proportion of which was embezzled. The poverty of the people can be seen from this picture of road-menders at work, the men having to use rags instead of shoes.

The people of the Baltic provinces are more intelligent than other Russians, owing to their contact with the rest of Europe. Their character and dress may be seen from this picture of an Esthonian girl.

Peasant girls of Lithuania, the country formerly included in the ancient kingdom of Poland, but later known as Western Russia. The girls are shown in the picturesque costume in which they often work.

Travelers tell us that it is a dead city now, where the people suffer from cold and hunger.

THE WONDERFUL CHURCHES OF RUSSIA, COVERED WITH GOLD AND JEWELS

It is difficult for us, who are used to plainer houses of worship, to realize the exceeding richness of the decorations in Russian cathedrals and churches. Not only were they adorned with marbles, agates, jasper, green malachite, blue lapis lazuli, and fine work in gold and silver, but there were many sacred pictures, often set with diamonds and other precious stones, and beautiful embroidered hangings, and many other works of art. Since the Revolution many of these churches have been robbed.

Next to the Admiralty is the famous Winter Palace, joined to the Hermitage, built by Catherine the Great, and beyond that is the Summer Garden and Palace. In these palaces were stored treasures of pictures, painted by the greatest artists of the world, and also most valuable and interesting collections which illustrate Russian history. The great library, in the Hermitage, used to contain more than a million books, besides an important collection of manuscripts. No one seems to know how many have been preserved.

THE SIMPLE COTTAGE OF RUSSIA'S GREATEST RULER

Just opposite these palaces, across the Neva, is the fortress and cathedral of St. Peter and St. Paul, the burial-place of the czars. Peter's boat, " the grandfather of the Russian Navy," in which he sailed about and gained much practical skill, is housed near the cathedral. Close by is the interesting cottage where " the giant wonder worker," as Peter was called, lived on the banks of the river while superintending the building of his city. Two rooms and a kitchen were all he required.

In the Artillery Museum is Peter's carriage with which he measured roads. The number of revolutions made by the wheels was registered by the machinery in the box behind—a sort of meter. On the lid of the box is a picture of Peter traveling, with forests in front of him, and newly built houses and newly laid-out gardens behind him.

MOSCOW, THE CITY OF GILDED SPIRES AND PAINTED DOMES

Visitors used to spend months in Petrograd and not come to the end of all the treasures to be seen in it--treasures from which they could learn much of the story of Russia and its peoples without opening a book. Then the visitor would naturally go on to Moscow, the ancient and the present capital, 400 miles southeast of Petrograd. Moscow is now the centre of the railway system of Russia, though the old water routes which connect it with distant parts are still much used. Over two million people used to live in Petrograd, and over a million in Moscow. Since the Bolshevist revolution many people have moved to the country with the hope of getting more food.

South of the city, where the Moskva River makes a great loop, are the Sparrow Hills. It was from here that Napoleon, surrounded by his staff, surveyed the glittering city at his feet. Thousands of housetops, and trees, and the winding river lie before us, but above all stand out the gilded and colored domes of the cathedrals and churches and the grim walls of the numerous monasteries. We have already glanced at the history of this city, and now we must visit the Kremlin, which is the Tartar name for a fortress. The Kremlin itself consists of a mass of buildings on the higher bank of the Moskva River, shut in by a wall, with towers and gates. It is, to religious Russians, one of the sacred spots, for here are the Synod buildings, where the Council of the Russian Church met in solemn state. Here were the ancient garments, some richly embroidered with pearls and precious stones, and the jeweled mitres worn by the patriarchs of the Eastern Church. Here, too, in the Cathedral of the Annunciation, the czars have been baptized and married, and in the Cathedral of the Assumption all the czars from Ivan the Terrible were crowned; in the Cathedral of the Archangel Michael, the old czars, down to the time of Peter the Great, were buried.

Many and greatly revered were the relics and sacred pictures called ikons, and treasures of jewels and gold and silver, to be found in the various buildings of the Kremlin. In the Tower of Ivan the Great are the famous bells which are rung on Easter Eve with such wonderful effect. The enormous " King of Bells," which is 19 feet high and weighs 198 tons, stands at the foot of the tower, with a piece knocked out of its side weighing eleven tons.

THE OLD AND NEW CAPITALS OF RUSSIA

In this view of Moscow we see the cathedral of St. Basil, one of the strangest buildings in the world. It has twenty gilded domes and towers, all of different shapes and sizes, and has been called "a nightmare in stone." This curious style of architecture is distinctly Russian, and similar churches are dotted over Russia.

Petrograd was built by Peter the Great, who drained the marshes of the River Neva by cutting canals, and so provided solid ground for the foundations of his new capital. Here we see the Nevski Prospect, the finest street in Petrograd. It is three miles long and very wide, and is lined with fine shops and public buildings.

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SOME OTHER IMPORTANT CITIES OF RUSSIA

It is easy now to pass by train to Kiev on the Dnieper, the mother of Russian towns, and, indeed, one of the most ancient towns in Europe. It has many fine old cathedrals, and also important trade and manufactures. Its companion, Novgorod the Great, near Lake Ilmen, called the cradle of the Russian Empire, bears many marks of its ancient and important history, dating from the times of the Scandinavian Rurik. Here, in 1862, a monument was erected to commemorate the 1,000th birthday of the Russian Empire.

Nijni, or Lower, Novgorod, on the Volga, is also a place of much interest, chiefly on account of the great fair which is held there every summer. It is said that the value of the goods brought to the fair used to amount to about $120,000,000; shops and bazaars, and all sorts of buildings cover a large space of ground, and the wares set out in them came from every part of Russia and beyond. There were iron goods from Tula, near Moscow, the Russian Birmingham and Sheffield combined; silks from Persia; precious stones and furs from Siberia and Central Asia; tea from China; rich carpets, dried fruits, cotton goods, silver ornaments, and all sorts of wooden boxes and toys made by the peasants.

HOW EAST MEETS WEST IN THE CITY OF THE GREAT FAIR

The wharves of Nijni Novgorod, where most of this merchandise is unloaded by sturdy Tartar laborers, are quite ten miles in length; and the various types of people seen selling, buying, and looking on, show that here Europe and Asia meet and trade.

Steamers ply on the great rivers, such as the Volga, with numbers of towns on its banks, and united with the distant seas by its tributaries and connecting canals. Its course approaches to within forty miles of the Don. Many are the stories of fierce warfare and pirates connected with the great rivers of South Russia in the past. Astrakhan is the port near its delta in the Caspian Sea, the headquarters of the large fishing industry carried on in that inland sea.

Odessa, on the Black Sea, is the great port of the South for sending away the grain grown in the fertile parts of Little Russia, sometimes called the Ukraine. This is the most fertile part of Russia, and raises large crops of wheat. Wool is exported from the steppes round the Black Sea, and there are engineering and shipbuilding works near this city.

THE BORDER PEOPLES OF RUSSIA STRIVE TO BREAK AWAY

After the Revolution many of the peoples on the borders of Russia attempted to break away and it is too early to say whether all of them will succeed. The independence of Finland, and of Russian Poland has been recognized and three little states in the West, Esthonia, Latvia (the country of the Letts), and Lithuania, seem well on the way toward independence if they can establish orderly governments and keep them orderly. Ukraine, the country of the Little Russians, in the south, has made several attempts to break away from the government at Moscow, but has not succeeded, as the people of the country do not think alike.

East of the Ukraine is the country of the Don Cossacks, who have always done very much as they pleased. They have threatened to break away several times, as these daring horsemen love to fight, but they have not yet been able to set up an independent government.

A MIGHTY MOUNTAIN, AND A SPLENDID ROAD ABOVE THE CLOUDS

Railways now run down from Moscow and other parts of Russia to the Caspian Sea, skirting the eastern edge of the Caucasus Mountains, which form such a high barrier between North and South. The highest peak, Mount Elbruz, tops Mont Blanc by about 3,000 feet. There is a splendid military road over the Dariel Pass, rising at parts into the clouds, with scenery like that of Switzerland. White peaks against the blue sky, dashing torrents, glaciers and avalanches, all seem especially beautiful after the bare steppes and rocky deserts that are found not far off.

THE EXTENT OF THE RUSSIAN EMPIRE IN ASIA

In the old Russian Empire, Russia in Asia was much larger than Russia in Europe though the number of people was not so large. This vast region was usually divided into three districts, Siberia, Central Asia and the region south of the Caucasus Mountains.

South of the Caucasus Mountains are three little districts which are claiming

THE STRANGE PEOPLE OF LONELY SIBERIA

The people of Siberia are a mixture of many races that have from time to time conquered or migrated to this lonely land. The people shown in this picture are Tungusians, a race that lived originally in Manchuria, but wandered south, east, and north into Siberia, their character largely influencing the peoples they conquered.

The Yakuts, shown in winter costume, are another race that went into Siberia from the south. They are more hardy and industrious than the Tungusians, through whose territory they fought their way.

Another Siberian race is that of the Giliaks, who live in the Amur valley. They are an ancient race, and related to the Ainos, the early inhabitants of Japan. In this picture we see a Giliak woman and her child.

The Yakuts, seen here and in the picture above, are huntsmen and cattle-breeders. In the cold winter months they live in curious houses like that shown here, with sloping walls made of wood, covered with clay, the roofs being of clay and peat. In summer they live a good deal in tents and in the open air.

their independence, and the Soviet Government at Moscow has been too busy to pay much attention to them. These are Georgia, Azerbaijan and Russian Armenia. The people are few and poor, and differ much in race, language, religion and ways of living. The region has great natural resources, and Baku, in Azerbaijan, is surrounded by some of the richest oil-wells of the world.

There are special boats and trains to convey this never-failing oil from the wells whence it springs, but, in addition, pipes are now laid, through which can pour daily over a million gallons of oil, straight to the tank-boats and reservoirs at Batum about 600 miles away. There are rich mines of manganese in Georgia, and some copper. Some of the land is very rich, but there is much disorder, and there seems to be little hope for peace.

THE WANDERING HERDSMEN OF CENTRAL ASIA

Central Asia is chiefly inhabited by nomad tribes which count their wealth in cattle, though there are some towns and many farms along the streams or in oases. Only about two per cent. of the land is cultivated. There is more pasture, but more than half is a desert where little or no rain falls. The railroad links together some of the fertile oases which lie like green islands in a sea of sand, watered by rivers which afterward lose themselves in the surrounding dry and rocky soil. Most of the people of Russian Turkestan are Mohammedans who wander with their flocks and herds seeking pasturage.

SIBERIA, WHICH INCLUDES SO MUCH OF ASIA

That part of the Russian Empire in Asia long known as Siberia, is more than twice as large as European Russia, larger than Canada or the United States, though very thinly settled. In all the vast area the population is scarcely more than 13,000,000. Before the World War the population and wealth were increasing rapidly. This was largely due to the Trans-Siberian Railway, built from Moscow across Asia to the Pacific Ocean. With its branches the length is nearly 6,000 miles.

This railway reminds us, in some ways, of those that run across America. It is longer, and much of the scenery is dreary and flat, and often it runs through endless forests. It crosses over the Ural Mountains near Ufa, a district famed for iron mines and foundries, as well as for its riches in gold and precious stones.

THE LONGEST AND ONE OF THE MOST MARVELOUS RAILWAYS IN THE WORLD

There are no tunnels, and there is none of the exciting, hairbreadth travel that the great lines of the Northwest furnish among the Rocky Mountains. In winter it is so cold on the Siberian line that meat, butter and fish need no refrigerating cars. The water for the engines has to be heated in winter, or it would freeze on the way.

A great feature of this line is the number of bridges needed. One that crosses the Volga near Samara is nearly a mile long, and many more are passed on the way through West and East Siberia, crossing over the immense rivers that drain so slowly and quietly across Siberia from the South to the frozen Arctic Sea. The Obi, the Lena, and the Yenisei are all, like the Volga, over 2,000 miles long; so is the Amur, which flows east to the Sea of Japan; and many of the tributaries which join the Arctic rivers are long and important, and have helped much in the development of the country. In West Siberia the railway runs through a belt of very fertile black earth, like that in Little Russia, where wheat is grown, and immense dairy farms are rapidly developing.

Thousands of settlers from other parts of Russia used to go every year by train to fill up the vast silent tracts of Siberia. The line runs past Omsk and near Tomsk, past Irkutsk, round and then across Lake Baikal—a most difficult piece of engineering; then onwards through Manchuria, which belongs to China, to Vladivostok, with some branch lines.

THE MONSTERS OF A PAST AGE WHOSE BODIES ARE PRESERVED TO-DAY

Many towns have grown up on the line, both trade centres and mining towns. Omsk is the centre of the agricultural industry of Siberia. At Irkutsk, the largest town in Siberia, are gold-smelting works, besides other industries, and a university.

The coldest place in the world is on the River Lena, where the difference in the winter and summer temperatures is the greatest known. There are islands in the Pacific where the temperature is almost the same all the year round.

At the mouth of the Lena, and in other parts of the Arctic shores, the remains have been discovered of mammoths with long, woolly hair, frozen hard in the icy

mud by which they were suddenly overwhelmed ages ago. Their flesh, when first exposed, was actually eaten by the wild animals prowling around. Some of the monsters have been preserved and set up in various museums, and interesting photographs have been taken of these creatures, so miraculously kept for centuries after all their kind had disappeared from the earth.

Many days were required to travel between Moscow and Vladivostok, and the last part of the line is full of reminders of the dreadful war between the Russians and Japanese in 1905, when Russian soldiers were brought across Asia by thousands on the Siberian Railway, to perish miserably in the struggle. The Russian Navy was practically destroyed near Port Arthur on the Yellow Sea. During the World War the railways were much injured.

Many strange-looking people are seen at the stations along the Siberian line—Chinese, Mongols, Russian emigrants, and wild people of the steppes. Some of these join the Siberian line, where it crosses the Urals, from the railway that runs through Orenburg, on the Ural River, from Tashkent, beyond the Sea of Aral, which, again, is joined to the Trans-Caspian line. Much trade with Central Asia comes this way.

Since the World War the government at Moscow has not been able to exercise much authority in Siberia. Several republics were set up at once. Some have already fallen and no one knows whether any of them can stand. Over a great deal of the region there is no real government.

ARCHANGEL FOR A LONG TIME RUSSIA'S ONLY PORT

The Ural Mountains run for over 1,000 miles to the Arctic shores, and form a great storehouse of mineral riches. Dreary plains of snow and ice in winter, and damp swamps in summer, lie between them and Archangel, on the White Sea, which for long was Russia's only port.

It is now connected by rail with Petrograd, and, in spite of its remoteness and the ice which closes its harbor for so many months in the year, vessels still trade there for oats, tar, and lumber. Peter the Great took much interest in developing this port. He built a quay and a fortress some miles off. The cottage in which he lived is still shown; also two of his boats, one built in England.

FINLAND, WHICH IS NO LONGER SUBJECT TO RUSSIA

It is easy to reach Finland from Petrograd; and before the World War, many visitors went there to fish, and boat, and bathe, for the clear lakes are delightful. There is enough fall in many of the streams to give water-power for various purposes, such as sawing and wood-pulping, and the towns are numerous and interesting, and most of them are full of reminders of Swedish days. Helsingfors, the capital, was founded by Gustavus Vasa in the sixteenth century, and has a Senate House and a university. Abo is a busy place, with much trade, and has an interesting cathedral, dedicated to the English St. Henry. The Finlanders are highly educated, and are deeply interested in reforms and good government, and in finding out the best ways of living.

THE AUTOCRATIC RULE OF THE CZARS

Now we come to tell more of the history of Russia in recent years. After the death of Alexander II., as we have seen on page 3729, he was succeeded by his son, Alexander III., who had married a Danish princess, an aunt of the present King of England. The new emperor had been inclined toward a liberal rule, but the manner of his father's death turned him to harshness. He refused to let the country have the constitution that his father at the time of his death was about to give, and the reign of Alexander III. was marked by a system of spying, which put a terrible weapon into the hands of the police. He tried, too, to force the Russian language on Finland, and on the Baltic provinces where Swedish is spoken, and because of his desire that all the people should belong to the Greek Church, the Jews in the empire were bitterly persecuted. Large numbers of political prisoners were sent to Siberia every year, sometimes only on suspicion, and the Russian government gained a reputation for intolerance, injustice, and oppression.

THE RUSSO-JAPANESE WAR AND THE STRUGGLE FOR FREEDOM

Alexander III. died in 1894, and was succeeded by his son Nicholas II., the last of the Czars. Nicholas at first continued the same hard despotic rule as his father, but gradually the voice of the people made itself heard, and although the laws were not changed for a long time, they were less harshly carried out.

In 1904 the Russo-Japanese War broke out, and resulted in the defeat of Russia, and the almost total destruction of her fleet. The heart of the people had not been in the war: they were too much engaged in the struggle for freedom which for years had been going on, and about the time that peace was signed, the Czar decreed that the country should have an elective council called the Duma.

The Duma did not at first work smoothly, of course. Naturally, the Czar wanted to keep as much power as possible, but by degrees things improved. The officials began to see that they could not always hold down the great mass of people. The Duma gradually gained more power, and many steps were taken in the direction of greater freedom, though under the Czar the Duma had nothing like the powers held by the legislative assemblies in free countries.

THE WORLD WAR AND THE DOWNFALL OF THE EMPIRE

Russia had come to be looked upon as the protector of the smaller Slav nations. Therefore, when Austria-Hungary attacked Serbia, Russia at once interfered and so was drawn into the war. Enormous armies were raised.

In the early part of the World War the Russian armies were successful, but later on were defeated and had to retreat. The conduct of the war was very bad. All sorts of supplies were lacking and thousands of soldiers were at first armed only with sticks. Many people said openly that some members of the government were in the pay of the Germans. The soldiers fought bravely, but they could not do impossibilities, and German and Austrian troops captured many prisoners and much territory. The common people grew very tired of the war, which seemed to bring only misfortune.

CZAR NICHOLAS II. FORCED TO ABDICATE AND LOSES HIS LIFE

Early in 1917, the Czar issued a decree, dissolving the Duma, which the Duma refused to obey. Food riots in Petrograd ripened quickly into revolution, and the Czar, who was accused of being in treaty with the Germans for peace, was forced to abdicate. He and his family were imprisoned, and later on were sent into exile and finally were killed by the revolutionary soldiers.

A Republic was proclaimed and a provisional government was formed. At first the new Republic seemed to be working smoothly, but the people became intoxicated with their new freedom, and the nation fell into wild disorder. The people, however, gave large powers to Vladimir Kerensky, one of the revolutionary leaders, in the hope that he might be able to restore order, but confusion increased, and those called Bolsheviki, claiming to represent peasants, workingmen, and soldiers, set up a new form of government called the Soviet.

WHAT THE GOVERNMENT OF RUSSIA IS TRYING TO DO

Only workers were to have any voice in the government, and the land was to belong to the state, which should also own and manage all railroads, manufactures, mines, forests and other enterprises. The right of private property was denied, and all should be tenants of the state. The workers were to decide upon the rules under which they would work and fix their own wages. The form of society which they attempted to set up is called communism.

Russia withdrew from the war, and set about building up the new form of government. A great deal has been written about conditions under the Soviets, and the writers do not all agree. It is safe to say that even those who sympathize with the government have been much disappointed. Prosperity has not come, and there has been much suffering for the lack of clothing, food and fuel, though Russia is rich in raw materials. There have been many plots to overthrow the government, and the border peoples have broken away. Though the Bolsheviki said that they were opposed to war, the government has a large standing army, and forced labor was introduced when it was found that many were idle. The chief men in the government have been Vladimir Ilitch Ulianov-Lenin, and Leo Trotsky. The latter was once an editor in New York.

In spite of all efforts to overthrow the government it has stood since the end of 1917, and no revolution seems to be in sight. Some of the plans have been changed when it was found that they would not work, but new ones intended to gain the same result have been adopted. Many of the more intelligent people have fled into exile or have been put to death and no one can foretell the futur[illegible] with order and prosperity seem far in the icy

THE NEXT STORY OF COUNTRIES IS

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THE GLORY OF THE FLOWERS
IN PARK AND GREENHOUSE

The world would be a dark place without its flowers. From the tiny forget-me-not and the chaste and fragrant lily to the massive yet delicate chrysanthemum and the blazing sunflower we have every shape and form and color and perfume. Singly or massed together, the flowers present a beauty that no artist can equal. In these pages, which show the flowers of the park, and the greenhouse, we see Nature in her lovely dress, but sights equally beautiful may be seen in the fields and woods, or beside the streams.

A BED OF TULIPS IN MAY, PHOTOGRAPHED IN REGENT'S PARK, LONDON

A FINE SHOW OF HYACINTHS, GIVING OUT A WEALTH OF RICH PERFUME

CHRYSANTHEMUMS IN THEIR NATURAL COLORS

'E STRIKING BEAUTY OF THE CHRYSANTHEMUM AS SEEN IN A GREENHOUSE

PLANT LIFE

WE have read the story of Animal Life, and we come now to the other great division of living things—Plant Life. Nothing is more wonderful than the flowers and plants that grow everywhere, filling the air with sweetness and making the earth beautiful to look upon. The story of the flowers is a story that never ends; we can never tell half of the wonderful things that are to be told about them. Some flowers are so small that we do not see them. The wind, the birds, and the beasts carry the seeds over the earth, and we can never grow tired of learning about the ways in which the flowers spread themselves. Some flowers throw up their seeds for the wind to catch and blow away; and all flowers have a wonderful cleverness in spreading themselves over the world. We read in this part of our book about the beautiful way in which Nature does her work, and we learn the story of the familiar flowers and plants of the garden and the countryside that delight us so.

HOW A FLOWER IS BORN

WHAT NATURE DOES TO KEEP THE PLANTS ALIVE

CONTINUED FROM 3750.

By EDWARD STEP

WHAT is a plant? That is a question not easy to answer without using many strange words; but in most cases it is perfectly easy to tell a plant from an animal or a mineral.

If we were to see a rose-tree, a dog, and a stone, we should be able to tell at once that the rose-tree is a plant, the dog an animal, and the stone a mineral. But there are some plants that we might think were just stains on the rocks; there are some others, very small, that we might think were animals if we saw them moving through the water; and there are some kinds of animals that we might think were plants.

Many years ago we were taught that animals and plants differ from stones because they live, and that an animal differs from a plant because it *feels*. To-day we know that many plants can feel. The plant is a living thing. It has no hands, no feet, no wings, yet it can move; and some plants can take hold and climb. It has no eyes, yet it can tell darkness from light. Some plants can even catch and feed upon insects. The plant can make starch, and sugar, and fat, and many other things out of air, water, and things it finds in the earth. It breathes.

There are several names for plants of different sizes or uses. There are trees, shrubs, herbs, vegetables, grasses, ferns, mosses, and toadstools; but they are all plants of different kinds.

Let us talk a little about all these kinds of plants, and see how they get their living. We ought all to know the great work the plants are doing for us. They make the lovely flowers we are so pleased to look at and to gather when we walk in the country lanes. But that is a very small part of the work they do for us. They give us nearly all our food and much of our clothing. They give us pure air; and, indeed, we could not live if there were no plants. Think what the world would be like without plants! I am sure we should say that it was a strange and dull world.

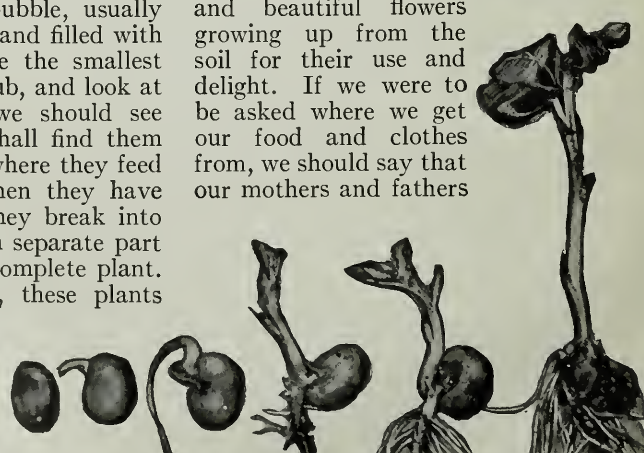
Before plants appeared upon the earth, the world must have been just a great ball of bare rock, with the sea and rivers in the hollows, and in the waters there may have been seaweeds. At first, the only place where grass and herbs could grow would be along the seashore, where the waves in great storms had broken off pieces of rock and ground them into sand.

Herbs and shrubs and trees want mold in which they can fix their roots, and mold has to be made by the plants themselves. How could plants make mold if there were no plants? we may ask. The first plants must have been very tiny ones without roots, and from the dead bodies of these enough mold

would be made in which moss or grass could manage to thrive. If we go out in winter, when there is a great deal of damp about, we shall notice patches of bright green on old fences and trees. This is made up of hundreds of thousands of tiny plants, so small that if we could place 3,000 of them in a row, so that they touched one another, the whole row would only just about reach across a nickel. Let us examine the small dot over this i. That dot, small as it is, is many times larger than one of these tiny plants, which have no roots, no stems, and no leaves or flowers. Each plant is, in appearance, just like a little round bubble, usually green, but sometimes red, and filled with fluid. If we were to take the smallest drop out of a rain-water tub, and look at it under a microscope, we should see hundreds of them. We shall find them in almost any little pool, where they feed upon the rain-water. When they have grown to their full size they break into two or more parts, and each separate part becomes round, and is a complete plant. When the pool dries up, these plants dry into a little dust, and the wind takes it through the air, and some of it sticks wherever the wind passes over a damp surface. Then the little dried-up plants soak up the moisture and begin to grow again. Of course, some of them die from old age, and their bodies decay. The wind also carries the seeds of mosses, and leaves some of them on such damp patches, where they grow. The lower parts of the mosses die, and make more mold. Then the living mosses on the top catch dust from the air, and with it come the seeds of ferns and other small plants, which now find mold deep enough to root in. Their roots find their way into chinks of the rock, and as they grow thicker they are strong enough to break up the surface of the rock. In time, we shall see, there will be a sufficient depth of mold for shrubs and trees, whose seeds may be carried far away by the wind, or dropped in distant places by birds as they travel on their annual flights from land to land. In this way the plants slowly covered up the bare rocks with their growth, and made it a place where insects and birds and grass-eating beasts could live. And after many, many years, men and women and children lived there, and found food and fruit and beautiful flowers growing up from the soil for their use and delight. If we were to be asked where we get our food and clothes from, we should say that our mothers and fathers

Insects carry pollen, a yellowish flower-dust, from flower to flower, and it is this dust that makes the seeds form. Here we see a long-tongued moth which carries pollen to a tobacco plant. Without this the plant could not give birth to other plants,

The seed of the Sand Box grows inside a skin, which bursts when ripe, and scatters the seeds.



Seeds are wonderful things. Each one contains a baby plant, with a root, a shoot, and a pair of fat leaves. When a bean-seed begins to grow it splits its jacket, and a little white shoot pushes into the ground. That is the root. Then the seed-leaves fall apart, leaving the plant to grow as shown in the picture.

give them to us. That would be quite true; and we know that they first get them from the butcher, the baker, the grocer, the confectioner, the tailor, the shoemaker, and so on. But these tradesmen only prepare the things we need. The true answer is, our food and clothes come really from the plants. The meat comes from the ox and the sheep, but these build up their bodies by eating grass. The baker's flour is the crushed seeds of wheat; the tailor's cloth is made from the sheep's wool; the shoemaker's leather is made from the skin of the ox; the merchant's linen is made from the stems of the flax plant.

Everything we need comes, in the first place, from the plants, and the plants make it all from air, and water, and rocks. Every breath we breathe *out* is poison to us, but the plants take the poison out of it, and make it fit for us to breathe *in* again.

If we were to place the wisest man upon an island where there were no plants, but plenty of rocks, air, and water around him, do we think he could make food and clothing out of them? We are sure he could not, even if he were the wisest man that ever lived. But the plants do it. And not only do they give us bread and milk, meat and potatoes, but juicy fruit and sweets to eat, clothes to wear, and lovely flowers to look at. Though plants have no hands or feet, and cannot talk, they must be very clever creatures to be able to do what man, with all his wisdom, cannot do.

In many of their ways plants are much like animals. They all try to get what are for them the best places. All the plants with green leaves need plenty of sunshine, and the trees in a forest are so afraid that their neighbors will shade them that they put out new shoots only at the top, to reach up as high as they can. Some plants are so good to eat that they have to cover their lower shoots, or leaves, with sharp spines, to prick the noses of animals that would eat them. Some make poisons instead of spines, and spread them in their leaves, so that no animal that has once tasted them wants to do so again. Others want bees to work for them, and these provide a sweet drink to attract.

What we call seeds are the eggs of the plant, and some of the plants like their seeds to be taken away where they will have more room to grow than if they dropped close to the old plant. So these plants fit each seed with a sail, that the wind may carry it off, or with hooks, which can be fixed in the coat of any bird or beast that passes by. Others shoot their seeds to the proper distance; but some that grow in less crowded places drop their seeds around them, so that their young ones may

SOME OF THE STRANGE WAYS IN WHICH PLANTS SPREAD THEIR SEEDS

Some plants send their seeds to grow far away from the mother plant, and these seeds have downy tops like the dandelion, on the left of the picture, or claws, like the starry-headed trefoil, next to it, or wings for the wind to carry them, like the maple-seed, which is seen higher up. Others have hooks to fix in the wings of birds or the coats of animals, and some, like the squirting cucumber, shoot their seeds some distance.

be able to grow up under the shelter of the parent plants. Now, these seeds are all very wonderful things. Each one of them contains a baby plant, with a root and a shoot and a pair of fat leaves. These seed-leaves are fat, because they are the pockets of the little plant, whose mother, before sending her baby plant away, has filled its pockets with enough food to feed it until it has its root firmly fixed in the ground, and its shoot growing up to the sun.

If we soak a bean-seed in water for a day, then lay it on moist earth in a flower-pot, and put it in a warm place, this is what will happen. The bean will soon begin to grow, and the first sign that it is growing will be the splitting up of its jacket, which has become too small for it. As the slit widens we shall be able to see that the real seed inside is in halves, joined together in only one small place. These halves are the bean's pockets filled with food, and between lies the baby plant. In a few days a little white shoot pushes out, and as it grows longer its pointed tip bends to the mold and pushes into it. That is the baby bean's root. When it is far enough in to get a good hold of the soil, it lifts up the bean, which had been lying on its side. Then the fat seed-leaves fall apart, and in between them we see a pair of very tiny leaves with their edges folded together. These little leaves grow very fast, and are soon as big as one's hand, and as they grow large the fat seed-leaves get small and wither. We see that the baby bean is eating up its food and its pockets are becoming empty. But now it has got those large green leaves it will be able to work for itself, and get all the food it wants from the mold and the air. And that is how the mother plant sends her baby away—always with enough food to last until it is old enough to get its own living.

Now that we have seen what a seed really is, let us have a short talk about how seeds are formed. We must know that the great object of every plant is to be able to ripen seeds, in order that the race may not die out. To ripen seeds the plant must first have flowers; and the plant's sole excuse for devoting so much of its energy and substance to the making of showy blossoms is that it must, at any cost, produce seeds.

Many plants, such as we call annuals and biennials, because they come up every year or every two years, ripen their seeds and then die. They have given their lives to this effort, and, the work being done, they die.

If we were asked which part of a flower we thought of most value, we should almost certainly point to the brightly colored petals, and say "These!" But we should be wrong.

The petals are of great value to the plant, and it pours its richest colors into them to make them as bright and showy as it can. Yet there are some flowers that have no petals. The most important parts of a flower are the green and yellow pins and threads in the centre; the parts that are often hidden by folds of the petals; the parts that some people think a fault when they appear in double garden flowers. Where there are bright petals they do not exist solely to make us pleased with the flower, but in order that insects shall be able to see the flower from a distance, and come to it, to help the plant to form its seeds. To induce the insects to come, many flowers are fitted with little glands that pour out from their surface a sweet fluid called nectar, and they also give out a sweet scent, which bees, butterflies, and moths look upon as a notice that sips of nectar may be had, free of cost, if they will follow up this scent to the bright-hued flower. The flowers that do not want the aid of the insects have small shabby petals, or no petals at all. Now, the plant that wishes the bee, the moth, or the butterfly to come to the flower, takes care that this nectar shall not be reached by ants, or beetles, or common flies; and hence all sorts of devices are used by the plant to guard its nectar from such

A PLANT THAT CATCHES FLIES

This plant, the Venus Fly-trap, opens its leaves to tempt insects inside and then closes them and traps the insect.

HOW FLOWERS INVITE THEIR LITTLE GUESTS

If we look at this picture of the honeysuckle, or woodbine, we shall see the pins and threads standing out from the mouth of the trumpet-shaped blossom.

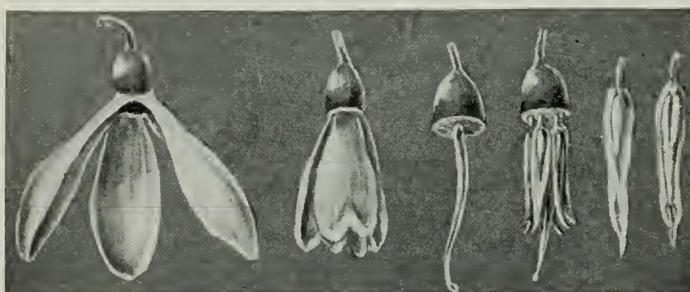
This is a spray of apple blossom. The apple blossom, like the buttercup and marsh marigold, attracts insects, and gives them nectar in return for pollen.

Flowers have many ways of attracting insects, to get an exchange of pollen. The first of these pictures shows us marsh marigolds, and the other is a photograph of buttercups. The marsh marigold and the buttercup seem to say to insects that all will be welcome, for they hold the nectar in little cups where all can reach it. The marsh marigold has large leaves after fertilization, but during the flowering period the leaves are quite small, so that they may not conceal the blossoms from insects that must visit them for fertilizing purposes.

robbers. The columbine and the garden nasturtiums have long, hollow tails, and the nectar is poured out at the bottom of these, so that only insects with long, thin tongues can reach it. The honeysuckle has long, trumpet-shaped flowers with nectar at the bottom.

But the tongues of moths and butterflies have grown into long, hollow tubes like the trunk of an elephant, and they can reach the nectar with ease. On the other hand, there are many plants that do not want bees or butterflies, preferring the visits of beetles and flies. These spread their nectar on flat, open parts of the flower where these short-tongued insects can lick it up. But the long-tongued insects are not too proud at times to take a drink at these flowers. English ivy has flowers of this kind; and in autumn, in places where it grows, swarms of bluebottles may be seen, greenbottles, bees, and butterflies, all crowding around the flat dishes on which the ivy has spread her nectar.

Flowers like those of the carrot spread their nectar on flat plates for the beetles and flies, so the butterflies pass them by as being too much like a fox's feast. Some plants, like the buttercups and marsh marigold, seem to say to insects in general that all will be welcome, for the nectar is held in little cups, in open flowers, where all can get at it without trouble. Some plants, like the foxglove, have so adapted their flowers to the shape and size of the humble-bee that no other insect can get at the nectar; for though it seems easy for small creeping insects to crawl into the large bell, their way is blocked by stiff hairs that are easily pushed aside by the strong bee. We have not yet learned *why* the flowers are so anxious for these insects to come that it is worth their while to attract them by bright petals and sweet scents, and then to reward them with nectar If we look at the honeysuckle we shall see the pins and threads standing far out from the mouth of the trumpet. There are six of these to each trumpet, and one is different from the others. Five are shaped like hammers with very long handles; the sixth is without the hammer-head, and ends in a little sticky knob like the head of a pin. If we pull the flower to pieces carefully, splitting the trumpet down the middle, so that we can see the bottom of it, we shall find that this long pin ends in a rounded green knob below the thin end of the trumpet. Inside this knob are many little white specks. The knob and the thread together are called the *pistil.*



SEPALS PETALS PISTIL STAMENS

These are the parts of simple flowers, such as the snowdrop. The snowdrop's bud hangs down and the white part splits into three sepals. The sepals spread out their tips and show us three petals inside. In the centre is a sort of pin called the pistil, with the seeds packed in the knob of the stalk, and around the pistil are six slender stamens, shown here attached and also loose, inside and out.

The five hammer-heads are *stamens.* They split open and give out a mealy, yellow powder called *pollen.* If a grain of pollen is placed on the sticky end of the pistil, the pollen sends out a shoot which pierces the pistil and finds its way right down to a little white speck in the knob, and pierces that also. Then a strange thing happens. The white speck begins to grow, the knob grows larger, and the trumpet drops off. The green knob becomes a juicy red berry and the white specks become seeds. But unless the pollen gets on the tip of the pistil there will be no seed.

In most of the brightly colored flowers the stamens and the pistil ripen on different days, or else the stamens are so placed that the pollen cannot fall on the pistil of the same flower. That is because these flowers cannot grow seeds from their own pollen. The insects fly to these bright flowers, and as they fly they pick up pollen on their hairy bodies and rub against the sticky pistils, leaving a little behind.

THE NEXT STORY OF PLANT LIFE IS ON 3889.

WHAT THIS STORY TELLS US

IF we make a careful examination of the brain, and especially of the new brain, we find that it is truly a double organ. It is easy to prove, in other ways, that the two sides of the brain differ very much in their duties and their importance; but actual examination of the brain itself does not show us the differences that we might expect. Though the brain has everything to do with the question of right-handedness and left-handedness, no one could tell whether a man was right-handed or left-handed by examining his brain. It is important to set this out clearly at first, lest we should think that one side of the brain is in some way inferior to the other. This is not so. One proof of this is to be found in the fact that either side of the brain can be educated for special purposes; and if one side fails, the other will do just as well, provided that we call upon it during our early years, when almost all things are possible.

THE PARTS OF THE BRAIN

CONTINUED FROM 3692

THE great majority of people are right-handed; only a few are left-handed. No one is perfectly equal-handed in everything he does. Many people have to be both-handed in certain respects. The violinist, for instance, has to train one hand for one kind of work, and the other for another, both equally difficult, though different. The pianist has to train both hands to do exactly the same work. Now, people who know nothing of this subject think sometimes that there is some natural difference between the two hands, or the two arms, or, as in the case of a footballer or an organist, between the two feet. That is a mistaken idea; the whole question is a question of brain, and we have already seen that there are no natural differences between the two sides of the brain, so far as we have been able to discover.

The first thing for us to do is to trace the connection between the brain and, say, the arm, and at once we find a very remarkable thing, which no one would have expected. If we begin at the great centre—in, for example, the left side of the brain—which controls all our intentional movements, we find that a large number of fibres from the nerve-cells in it are gathered together to form a bundle, which is, of course, the great path of the will. This bundle runs down through the brain—on the left side, of course—but gradually approaches the middle line of the body, and then, at a certain point, practically the whole of it crosses over to the right side. This happens in the part of the brain called the bulb. The consequence of it is that the left side of the brain is the master of the right side of the body. Exactly the same is true in respect of the right side of the brain and the left side of the body.

When we call a person right-handed, then, we really mean that he is left-brained, and that a left-handed person is right-brained. In either case we must describe the brain as having a leading or more important half, and in a short time we shall come to see that when a person is left-brained, this affects not only the use of the right hand, but many other functions of the body.

Now, we have already learned that the two sides of the brain at birth are exactly the same, so far as anyone can make out, and even in later years no one can find any difference between them. Why, then, do people become left-handed or right-handed? Why are there so few left-handed to so many right-handed people? And, if the two sides of the brain are naturally the same, why are we not all both-handed? It is best to begin answering these questions by settling

the last point first. The reason why we are not both-handed is a matter of economy. Life does not like waste. If one thing will do her purpose, Nature does not employ two. When the education of the brain starts, if one side of the brain has the advantage, Nature favours that side. Nature is like a schoolmaster with two boys in his class, one of whom gets a slight start, while the schoolmaster neglects the other altogether.

WHY ONLY ONE SIDE OF THE BRAIN NEEDS TO BE EDUCATED

There is no need for both sides of the brain to be equally educated. One side gets an early advantage, and then the more it has, the more is given to it. But it must never be forgotten—though it usually is forgotten—that the less-educated side of the brain is naturally just as good, and has quite equal possibilities of being the leading half; so that there is always this other half of the brain to fall back upon. We must see how this works out.

A man of seventy may meet with some kind of accident or injury, visible or invisible, which prevents the working of the leading half of his brain—the left half, if he is a right-handed man. There is still the right half of his brain available for the same kind of work. With labour and patience, he may be able to teach the right half of his brain to do very imperfectly one or two things which the left half of his brain used to do. But I fear that in cases like this the poor man is almost as badly off as if he had nothing to fall back upon. The reason for this is that when people get old the brain's power of learning becomes less. During youth is the best time to learn. Now let us take the case of a little child of five or thereabouts: he can talk, and perhaps even read a little; he can draw and even make a few simple letters with his right hand.

HOW THE BRAIN REPAIRS AN ACCIDENT TO ITSELF

Some accident may affect the working of the child's brain, just as in the case of the old man; but the difference between the two cases is tremendous. The right half of the little boy's brain now simply takes the lead. It is true that, as we shall learn, he has to begin again by saying "Papa" and "Mama," just like a tiny baby; but yet, because his brain is young and still developing, a child like this will, in a year or two, be practically as well off as if the accident had never happened at all. Such cases are not very common, but they are quite well known.

But we have still set ourselves some questions which must be dealt with. We have already decided why people do not become both-handed, unless, like the pianist, they have some special reasons for setting both sides of the brain to learn the same lesson. But we still have to find out why there are about ten or more right-handed people to one who is left-handed, and the puzzle is greater because, as we have seen, there is nothing to be found in the brain itself to explain this difference.

Well, in the first place, it is certain that custom, tradition, and prejudice have something to do with the difference between the numbers of right-handed and left-handed persons. It is probable that a very considerable number of children, at any rate, are born with no natural bias in favor of either hand.

RIGHT-HANDED PEOPLE AND LEFT-HANDED PEOPLE

It is interesting to make observations on babies in this respect. Often it is impossible to make out that they prefer the use of one hand to that of another, but when we begin to teach them things, we usually favor the right hand; in other words, it is the left half of the brain that gets all the practice and education, and so it gets the lead. We notice this in games as in everything else.

In England it has been noticed that many cricket-players from poor families throw, bowl, and catch with the left hand, but they bat right-handed. Many of these were, I believe, naturally left-handed. They preferred to throw with the left hand long before they started cricket; but when they began to learn to use a bat, they were told to stand in a right-handed position. In cricketers drawn from wealthier families, it is very seldom that left-handed players are found, and especially left-handed batsmen. The reason is that as boys they were specially looked after from the first, and even those who would naturally have become left-handed have been made right-handed. When we notice things like this, we can understand that a great many of the estimates which are made as to right-handedness and

left-handedness are mere nonsense, because those who make the estimates forget the whole question of education. Some well-known authorities, for instance, have said that there is some relation between crime and left-handedness. The real truth is, however, that there is a connection between crime and lack of education, and there is more left-handedness among uneducated people, because there are fewer parents and teachers to be particular as to which hand the child uses. There is absolutely no connection whatever between right-handedness or left-handedness and any of the higher qualities of mind and character.

But, even when we allow for education, it seems quite certain that there is a commoner natural bias towards right-handedness than towards left-handedness, and this requires explaining. One kind of explanation is that the tendency is inherited, and this is interesting as far as it goes, but, of course, it does not tell us how the tendency began.

WHY SOME BABIES ARE BORN RIGHT-HANDED AND OTHERS LEFT-HANDED

It seems quite certain that even apart from imitation and education, right-handed parents tend to have right-handed children, and left-handed parents to have left-handed children. Of course, in making studies like this, it is all-important, and also very difficult, to be sure that we allow for the consequences of education and imitation. But, with care and trouble, it is possible to do so, and then it becomes clear that heredity works in this way.

We already know that the question of the supply of blood is, perhaps, the most important of all questions for any living tissue; we know that it is, above all, important for nerve-cells. It requires only two or three seconds' interruption of the flow of bood or nerve-cells to stop working, as we see when a person faints. Thus it would be very interesting if we could find any difference in the blood-supply of the two sides of the brain; and some people have supposed that perhaps the left side, as a rule, gets a more rapid and fuller supply of blood than the right. If we examine the blood-vessels of the chest, from which run the arteries to the head, we find a certain amount of evidence in favor of this view. The arteries are so arranged that the blood-supply to the left side of the head seems to be a little more direct than to the right side. But when we examine the brain itself, it is impossible to find that either side is better favored with blood than the other, and it is not thought that this question, about which a great deal has been written and argued, is of very much importance.

SOMETHING ABOUT THE BRAIN THAT NO MAN UNDERSTANDS

The truth is that, after all these years of study, and though a whole library of books has been written on the subject, we still do not really know why more people should be left-brained than right-brained, except in so far as we know that the bias of education is partly responsible.

This question would be far less important if the difference between the leading half and the led half of the brain were only a matter of the comparative skill between the two hands, and that, of course, is what most people think. But, really, that is far and away the least part of the whole matter. Within the last twenty or thirty years we have learned that the right-handed—that is to say, the left-brained—person is not only more skilful with the left side of his brain in the use of his hands, but he speaks and writes with the left side of his brain; he reads with it; he follows music with it; and left-handed people do all these things with the right side of their brains.

Let us begin with the case of hearing. Everything goes to prove that, so far as the mere hearing of sounds is concerned, the two sides of the brain are quite equal in every healthy person; but there are certain kinds of sound which we call language, and they introduce another need. It is not sufficient to hear; we must also understand, for we may hear someone speaking in a language without understanding it.

THE SPECIAL PART OF THE BRAIN THAT UNDERSTANDS WORDS

It has been proved that in right-handed people the understanding of words is entirely done by the left side of the brain. A special part of the brain there has been taught to perform the duty of understanding words. It is called the word-hearing centre. If it is thrown out of action by anything, the person will hear perfectly, but only as a child hears, or as we hear an unknown

language. There is good evidence to show that, where people know more languages than one, the understanding of them is not all mixed up in one particular part of the brain, but that they have their own little centres, developed by education, situated near or on the outskirts of the ordinary hearing centre in the leading half of the brain, whether that happens to be the right or the left.

WHY WE SOMETIMES HEAR WORDS WITHOUT UNDERSTANDING THEM

We have all noticed that sometimes, when we are not attending to the talk of those around us, we hear that something has been said, but do not understand it, and so perhaps we say: "I beg your pardon"; and before our friend has time to repeat what he said, we have understood it. The words were recorded and heard in the hearing part of the brain, but the reason why we did not "take in" what was said was that the sounds had not been *taken* from that part to the word-hearing centre where alone they could be interpreted. A second later, when we attended, that happened. A case like this helps us to understand not only the working of the brain, but also what is meant by attention.

In the case of music, too, it is one thing merely to hear, and another to understand. In this case, also, it seems that there is a special centre developed in connection with, and close to, the hearing centre in the leading half of the brain. The brains of some well-known composers have been examined after their death, and it seems clear that some of them have a specially rich development of the cells in this part of the brain.

THE MANY LESSONS WE COULD LEARN BY EXAMINING A GREAT MAN'S BRAIN

It is worth while to note, in passing, that a valuable service is rendered to future generations when a great man, whose brain has already been invaluable to humanity, gives orders that, when he dies, his brain may be examined, so as to add to our knowledge of this most wonderful of all wonderful things. In point of fact, we are only just at the earliest beginnings of our knowledge of the brain and its working. We know a little of the brain in general, but we have practically everything yet to learn as to the all-important and endless differences between one brain and another. At present the study has almost entirely to be made upon brains of persons who were not at all noteworthy, but our biggest need is to study the brains of great and unusual people.

It is known that not a few of the wisest of living men have given orders that, after their death, their brains are to be examined for the advancement of knowledge. We have yet to learn all about the brains of people of great general ability—people who are very clever with figures, artistic people, musical people, clever writers, great thinkers and so on. There is an extremely interesting theory about the finest kinds of brain, which we shall learn in a little while.

Now let us turn to the case of seeing. We are certain that things are seen perfectly on both sides of the brain, but we know that in right-handed people, for instance, it is only in the left half of the brain that reading is accomplished. If the word-seeing centre is thrown out of order, the person will see as well as ever he did in his life; he could make perfect copies on a piece of paper of the letters he has in front of him; but they mean no more to him than to a baby.

A SENSE THAT IS GREATER IN MAN THAN IN ANY OTHER CREATURE

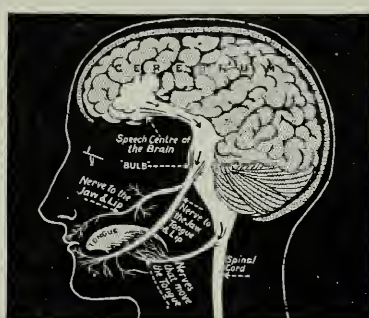
It is also probable—though we do not yet know this for certain—that, just as is true in the case of music, the higher kinds of seeing are done in the leading half of the brain. It may be that the kind of seeing done by the artist is done by the leading half of the brain. According to some students it may even be that we also appreciate color in the leading half of the brain.

This is a subject about which we have yet a great deal to learn. It is possible, however, to find out, in a given brain, very precisely what are the exact limits of the seeing area, which, as we know, is at the very back part of the new brain. Now, we find that this seeing area has been growing, so to speak, for ages past in the main line of progress of animal life, and that it is much larger in man than in any other creature; it also varies very largely in different human beings. In the brains of many idiots, and also in the brains of some of the lowest savages, we find very notably that the vision area is small compared

with what we find in the brains of healthy individuals of the higher and more intellectual races of mankind.

Now, the hearing and seeing of words come first in order, so to speak, because we must receive before we can give; and after that we ought to study the way in which we speak and write. Of all these various centres, it is, of course, the word-hearing centre that first develops in a child and after that the speaking centre. These really form a pair. In persons who have been taught to read and write, another pair is developed — the reading or word-seeing centre and the writing centre. Let us now study the speech centre.

We have only to think for a moment to realize that in some ways the speech centre must be the most wonderful and important part of the human brain. Of course, reading and writing are enormously important, but then they are really only a newer kind of speech, after all. Now, it is speech, or language, that is one of *the* great marks of mankind. In many ways we are human just because we can speak, and so we may say that the speech centre in our brains marks the beginning of what really has made, and makes, us human, and far more wonderful than any other living creature that is known.



This diagram shows the speech centre of the brain, known as Broca's area because it was discovered by a Frenchman named Broca. The same part of the brain controls the muscles of the lips, tongue, and jaws. The arrows show the direction in which the nerves convey the impulse to the muscles.

Of all the special centres in the human brain, this was the first to be discovered, which is very appropriate, as it must have been the first to be developed. It was discovered by a celebrated Frenchman named Broca, about the middle of the nineteenth century and is known as Broca's area. In the picture on this page, showing the left side of the brain of a right-handed person, we see the speech centre. If we examine the brain from another point of view, and note, in the area for motion, the various points that control the different muscles of the body, then we find that the speech center lies in the same part of the brain as that which controls the muscles of the lips, tongue, and jaws. But it would be a great error to suppose that that is all the speech centre does. The muscles which we use in speaking are all represented on both sides of the brain; but it is one thing to be able to move them, and another to be able to speak with them. If anything happens to throw the true speech centre out of action, the person can still use all his muscles.

If we say a word, he can say it after us; but he can no more speak, in the real sense of speaking, than an animal can. He may imitate like a parrot, but that is all. The only exception to this is that, in many cases, just a few words, like yes and no, are still kept, and the reason seems to be that they have been so often used that they have found a home in the other side of the brain also. It has been discovered, also, that rough persons who use bad language are still able to use an oath or two when all the rest of their power of speech is gone. They have used these words so very many times that they seem to have become firmly fixed in both sides of the brain. Though the speech centre has been known for many years now, and though the study of illness and accident has taught us a good deal about it from the point of view of disease, we still have almost everything to learn about it from the point of view of health. Everyone knows that different races and different individuals vary very much in their power of speech. Everyone knows, too, that some of the wisest and most thoughtful of men speak slowly and with hesitation and with many mistakes even in private conversation, while they can speak in public scarcely at all. On the other hand, men who are neither wise nor thoughtful often hold a large audience spellbound for an hour. But sometimes a wise man may also be a good speaker. These facts express a truth which applies generally to the whole of the brain and its uses. It is that different parts of the brain vary independently of each other. One man may have a splendid speech area, and

the rest of his brain may be commonplace; or it may be the other way round. We have all heard what was said of the poet, Oliver Goldsmith: "Who wrote like an angel, and talked like poor Poll."

One of the few really great poets of the last half century, who wrote many poems which will be read as long as English is read, was a most stupid and hesitating and commonplace talker. This proves that the speech area of the brain, like other areas of the brain, is an extremely independent thing.

THE POWER TO TALK, WHICH CAN MAKE FOR GOOD OR FOR EVIL

This has a very great importance for any nation that is governed as we are governed. Many people think that all that is necessary to prove a man a good law-maker is the power to speak well on any subject. Now, everyone who votes for members of our Congress ought to know that the mere power to talk, though it is a very notable thing, and may be a very useful thing, and has often altered the history of nations for good, has yet often altered their history for evil, and so helped to destroy them.

The wise, strong, priceless man may be silent; it is even possible that he may be so busy thinking that he has not time to speak! Wise people who look around them know all these facts; but the interesting thing is that our modern knowledge of the brain, and especially what we are learning as to the independence of the different parts of the brain, and the way in which they vary in different people, independently of each other, all teach us the same lesson. It will be a very good thing when all of us who have a share in deciding who shall govern us use our educated judgment in this very important matter.

THE DIFFERENCE BETWEEN FINE BRAINS AND COMMON ONES

And now we may consider a theory which probably helps us to explain in some degree the difference between fine brains and common ones. There would certainly be a great difference between a pianist who always practised with one hand only, and always with the same hand, and another pianist who practised with both hands. If the two sat down one after the other to play a great piece of music, everyone would know the difference. Again, it can be proved that it makes a great difference to people whether they use only one eye in looking about them, or whether they use two. In the case of those people who do not see straight, or in people whose eyes are very unequal, which is more common, we find that the constant use of one eye only greatly deprives them of the power of judging distances, of seeing perspective, and of realising the depth and solidity of things.

Anyone who has ever looked through a stereoscope knows what a tremendous difference it makes to look at an ordinary photograph, and then to look at a stereoscopic view, using both eyes. When we use both eyes, that is a case of what is called binocular vision. A very wise man, called Dr. John Brown, who wrote "Rab and His Friends," suggested many years ago that some people seem to differ from others as if their thinking were, so to speak, binocular, and so they had the gift of seeing the perspective and depth of things. This is a rather good idea. Herbert Spencer, also, had the same idea as Dr. Brown; but, as he was a great student of the mind and the brain, he was able to develop the idea.

GREAT THINKERS, WHO USE BOTH SIDES OF THE BRAIN

He suggested that in good thinkers the two sides of the brain were probably used together much more than in ordinary people. When we look at the huge bundle of fibres that run across from one side of the brain to the other, we can see the force of this. Some day it may be proved that Herbert Spencer's theory is true, not only of thinking, but also of understanding and creating poetry and music, beautiful pictures, and so forth. One of the deeply interesting questions yet to be decided, probably by the present generation, is how far and in what ways, by our education of the young, we can develop to the utmost both sides of the brain, without waste of power and without lowering the quality of the education of both sides. This last is a most important point. There is nothing gained if we educate both sides of the brain to a lower standard than we could reach if we worked on one side. We must be content to let one half of the brain lead and the other be led.

THE NEXT PART OF THIS IS ON PAGE 3913.

THE MAN WHO CARRIED DEATH

CONTINUED FROM 3740

FORTUNATELY, the days have passed away when the majority of people thought of war as something grand and glorious. Even those who believe that war is sometimes necessary are agreed that, whatever may be the cause that leads to fighting and bloodshed between nations, war is undoubtedly one of the greatest evils that can happen to any people. And yet the annals of war tell of many great and heroic deeds—deeds not merely of fierce daring in the destruction of the enemy, but of courage and endurance in the saving of life.

During the Crimean War a gallant deed of this kind was performed by Captain William Peel, the commander of one of the British warships, whose men had landed to take part in the fighting on shore. Captain Peel and his men were sent to a certain place where the guns were keeping up a constant fire upon the enemy's position. Suddenly the ammunition was found to have given out, but a number of men at once volunteered to go and bring the ammunition to the battery, although to do so was to run into the greatest danger, as Russian shells were falling and bursting all round. At last the boxes of powder and shot were brought to the battery, and the men were hastily unpacking them, when right into their midst dropped a large shell from the Russian lines. The fuse was burning, and in a moment or two the whole battery must have been blown to pieces. The men stopped in their work, and looked at the shell as though fascinated, expecting every second that the shell would burst and destroy them.

But Captain Peel was a man of action and of great presence of mind. Without a moment's hesitation, or a thought of his own safety, he rushed across the battery, seized the shell, and ran with it to the side of the battery.

The other men found their voices in a moment, and shouted: "The fuse is burning! Look out, the shell will burst!" But Captain Peel continued to run with the shell away from where the others were standing, and, raising it high above his head, hurled it over the earthworks that protected the guns.

Scarcely had the shell left his hands when it exploded with a terrific crash. A moment or two later and the brave captain would have sacrificed his own life in the effort to save his men, for when the shell fell into the battery Captain Peel could easily have escaped; but his courage, energy, and presence of mind saved the whole of the band of men who were unloading the ammunition and serving the guns.

For this gallant deed Captain Peel was awarded the coveted Victoria Cross.

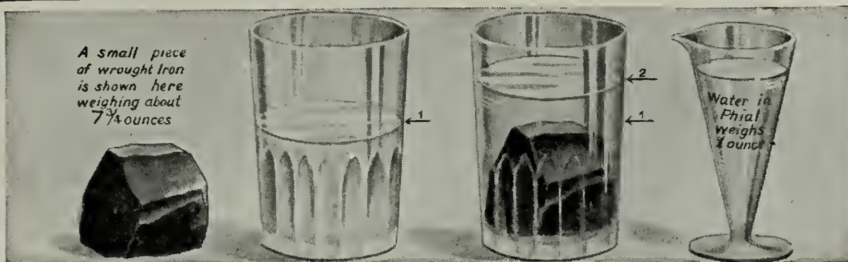
THE PICTURE OF A GOLDEN DEED

A YOUNG Scotch minister went one day to visit the birthplace of Thomas Chalmers in an ancient and obscure town on the Firth of Forth. When he had examined this house, he and his companion entered an inn for refreshment. The room into which he was shown had its walls covered by absurd pictures, such as shepherdesses with crooks and sailors home for the holidays. But over the mantelpiece was a picture of quite another kind, making a very strange contrast with the rest. This picture represented the gloomy interior of a cobbler's shop. The cobbler was seated on his stool—an old man with spectacles pushed up over his brow, a shoe between his knees, and a hammer in his hand. The massive forehead and firm mouth suggested strength of character and an iron resolution. But under his bushy eyebrows two of the kindest eyes in all the world beamed with benevolence on a half-circle of ragged boys and girls grouped before the old man with lesson-books in their hands. The young Scotch minister read the inscription, which told how John Pounds, a cobbler in Portsmouth, took pity on the multitude of poor ragged children left by ministers and magistrates, and ladies and gentlemen, to go to ruin in the streets; how, like a good shepherd, he gathered in the wretched outcasts; how he taught them and trained them to God; and how, while earning his daily bread by the sweat of his brow, he had rescued from misery and saved to society not less than five hundred of these children. The young minister was the famous Dr. Guthrie, and this humble picture of John Pounds led him to become the apostle of the Ragged School movement. "I felt ashamed of myself," he related afterwards. "I well remember saying to my companion: 'That man is an honor to humanity, and deserves the tallest monument ever raised within the shores of Britain.' I took up that man's history, and I found it animated by the Spirit of Him who had compassion on the multitude." John Pounds was a clever man besides, and, like Paul, if he could not win a child any other way, he won him by art. He would be seen chasing a ragged boy along the quays, and compelling him to come to school, not by the power of a policeman, but by the power of a hot potato. Often on a cold winter morning he used this bait to draw a child to his little workshop, which was also his schoolroom. He loved children, and knew what a treat a baked potato was to a hungry child. When the day comes when honor will be given to whom honor is due, we can fancy the crowd of those whose fame poets have sung, and to whose memory monuments have been raised, dividing like the wave, and, passing the great and the noble and the mighty of the land, this poor obscure old man stepping forward and receiving the especial notice of Him who said: "Inasmuch as ye have done it unto one of the least of these my brethren, ye have done it unto Me." This is an example of the great influence of a picture. In seizing Dr. Guthrie's imagination, this picture became a great influence in the lives of many thousands.

JOHN POUNDS, OF PORTSMOUTH

THE PICTURE THAT HELPED DR. GUTHRIE
From the painting in the possession of Sir John Kirk.

THE NEXT GOLDEN DEEDS ARE ON PAGE 4025.



When a piece of iron is placed in a glass of water it displaces its own bulk of water, and the liquid rises from 1 to 2 as in the second glass. If the displaced water and the iron be weighed, it will be found that the iron is about 7¾ times as heavy as the water, and so its specific gravity is 7¾.

THE SIZE & WEIGHT OF THINGS

CONTINUED FROM 3676

WE read about the way in which things are measured—about the measurement of time, temperature, mass, and so forth, on page 3671. We may also learn to distinguish between weight and mass, and we may learn something about the balance of forces. We must now learn a little more about gravity, and then about another very interesting thing which is called specific gravity.

In the case of gravitation, we can allow things to drop, and measure their rate of falling, as we read on page 3674. It is very difficult, however, to get accurate results by this method. Far more precise results can be obtained by the use of a pendulum, for the rate at which a given pendulum swings depends upon gravity; and when we try this method we find that one and the same pendulum will swing at different rates in different parts of the world.

This can only mean that the force of gravity is not the same in different parts of the world. We know that the earth is flattened at the North Pole and the South Pole. This means that anything at the Equator is farther away—several miles farther away—from the centre of the earth than it would be if it were taken to either the North or the South Pole. As the force of gravity varies with distance, a thing must therefore be heavier at the Poles than at the Equator.

But there is another reason why this should be so. The earth is spinning all the time. If we could stand upon either Pole of the earth, we should, of course, spin round once in twenty-four hours. If anything were placed six inches from the Pole it would, of course, describe a little circle round it in twenty-four hours. This movement would be very slow indeed. But very different is the case of that same thing if we take it to the Equator.

At the Equator the circumference of the earth is about 25,000 miles, and just as the thing near the Pole has to travel a few inches in twenty-four hours, so at the Equator it has to travel 25,000 miles in twenty-four hours—more than a thousand miles an hour. Now, we know that anything moving in this way on the surface of the earth—like the stone in the sling, as we see in the picture on page 3676—tends to fly out at a tangent to the circle in which it moves, and this is stupidly called "centrifugal force."

This, of course, applies to anything on a spinning body like the earth. The quicker the thing moves, the greater is its tendency to fly out; in other words, the so-called centrifugal force becomes greater and greater, the nearer anything approaches to the Equator, for the nearer it is

to the Equator the more quickly it is bound to move. This force acts against the earth's gravitation; indeed, it is the earth's gravitation that prevents things from flying out, and keeps them traveling in a circular path on the earth's surface, though the motion in them—like that of a stone in a sling—wants to make them fly out.

THE PULL OF THE EARTH, THAT GETS LESS AS WE APPROACH THE EQUATOR

Therefore, as the force acting against the earth's gravity increases as we approach the Equator, the force of gravity, when we weigh it, seems to be less the nearer we go to the Equator. It actually is less, because we are farther from the centre of the earth.

We know that gravity has the power of increasing by 32 feet in every second the rate at which anything falls to the earth. It is this rate by which we measure gravity, and now we can say more exactly what the figures are, and we can also learn the proper way in which to state them. We can take, for example, the first letter of the word gravitation, and we can let the letter g stand for the intensity of gravity in any part of the world. In England the value of g, we say, is about 32.2 feet per second; that is to say that for every second that anything falls in the British Isles its rate of falling is increased by about 32.2 feet each second; in other words, gravity produces, in England, during every second of its action, an acceleration—that is, a quickening—of 32.2 feet each second.

Now, the value of g at the Poles is about 32.25. We know that .25 is a quarter, so that for every second during which a body falls at the Poles, gravity increases its speed by about 32 feet 3 inches; whereas in England the 3 inches would be nearer 2 inches. The value of g at the Equator is decidedly less than 32.1; so that the acceleration will be very little more than 32 feet 1 inch every second.

THE MEANING OF SPECIFIC GRAVITY, AND WHY IT IS IMPORTANT

We must now go on to study something else which depends upon gravity, and which is called *specific gravity*. The word specific, which is very much used in all the sciences, is really only another form of a word which we all know very well, and that is the word "special." We talk of the specific gravity of a thing, or of its specific heat, or the specific characters of a particular kind of animal or plant, and in all these cases the word practically means special.

When we talk of the specific gravity of anything, we are simply using a short expression for the amount of stuff in it in proportion to the space it occupies. A pound of lead takes up a great deal less room than a pound of wood; the lead has more stuff or matter in a given space. If we remember the word mass, we may say that the lead is more massive.

This question is very important, because of the great results which follow from the differences in the specific gravities of things. One thing floats and another sinks. When we run hot water into a bath of cold water, the hot water floats on the top of the cold; if we run cold water in after hot water, it runs as a stream at the bottom of the hot water; the warm breath from our lungs rises in the cooler air into which it is breathed; a balloon filled with hot air or hydrogen will float, or rise, and so on. All of these facts, and thousands more, depend upon the important question of specific gravity.

WHY WE USE WATER AS A STANDARD FOR MEASURING WEIGHTS OF THINGS

We are now faced again with the question of measurement. We want to be able, in some short and simple way, to say how heavy gold is compared with water, or how heavy water is compared with alcohol, and so on. That is the way we put it in ordinary speech. We say that one thing is heavier than another; we do not mean that a pound of gold is heavier than a pound of water, but that we can get a greater weight of gold than we can of water into a given space. Gold has a greater specific gravity. Water is such a common substance, and so important, that we may take it as our standard.

Ordinary water contains various things dissolved in it, especially gases, and these make a difference. So when we speak of water in this connection, we mean distilled water, but this is not all. We know that, as a rule, when things are heated they expand, and when they are cooled they shrink. The amount of stuff in a given space changes; in other words, the specific gravity changes. So it will not do to say distilled water. We must know at what temperature we

are considering it. When we study water, we find that it is densest, most shrunken, or heaviest, when it is 4 degrees centigrade above its freezing-point.

On the sensible centigrade scale, the freezing-point of water is nothing, so that 4 degrees centigrade indicates the temperature at which water is densest. Now, we can take this as our standard. The specific gravity of pure distilled water is 4 degrees centigrade, which we shall, for convenience, call 1; then, if we find anything that has twice this specific gravity, we shall call that 2, and so on.

We must choose all sorts of different things, and compare the weight of a given volume of each with the weight of an equal volume of water at 4 degrees centigrade. Here we are measuring weight, of course, and we are using it as an indication of the mass in the things we are examining. We are perfectly entitled to do this, because Newton has taught us that the weight of everything depends upon gravity, and that the force of gravity depends precisely upon mass. So if we compare the weight of things, we are really comparing their masses.

HOW WE MAY FIND OUT THE SPACE OCCUPIED BY ANYTHING SOLID

Now, suppose that we want to find out what is the specific gravity of some odd-shaped thing. We can weigh it all right, but we want to know more than what it weighs; we cannot tell its specific gravity until we know how much space it occupies, and if it is an odd-shaped thing, this may not be at all easy to find out. If it is a thing shaped like children's blocks, there is no difficulty. With a thing of irregular shape, we can easily find out how much space it occupies by putting it into water, and noticing how much the water rises.

It is often very important to study the specific gravity of liquids. For instance, milk ought to contain in itself a certain amount of solid matter melted in it. It is for this solid matter that we buy the milk, as it gives it its food value. If water is added to the milk, we are being cheated. And surely we are being cheated no less if the cow is made to drink large quantities of water, which really comes to the same thing. There must be some way in which we can tell whether the amount of solid matter dissolved in the milk comes up to the standard, and we can do this by measuring the specific gravity of the milk. In the case of spirits, we want to know how much alcohol they contain, and we can do this by ascertaining their specific gravity. These are two common instances, but, of course, very many others could be mentioned.

A LITTLE INSTRUMENT THAT TELLS THE SPECIFIC GRAVITY OF ANY LIQUID

There is a simple little instrument called the *hydrometer*, which means water-measurer, by which anyone can find out in a moment the specific gravity of a liquid. It is simply a glass tube with a weight at the lower end, and with a scale marked on it, like that on a thermometer.

The heavier the fluid in which we place the hydrometer, the less is the depth to which it will sink before it floats. On the tube is a mark which shows the level at which the hydrometer will float in water. If the liquid is lighter than water, as, for instance, alcohol, the hydrometer will sink deeper than this mark; if it is heavier than water, like milk, the hydrometer will not sink so far. We shall see in a little while what are some of the results that are obtained with this simple little instrument.

Another kind of instrument for measuring specific gravity is called a specific gravity bottle, and it is very simple and easy to understand. It can be used sometimes for measuring the specific gravity of liquids, and sometimes for solids. The bottle has to be very carefully made, so that it will hold exactly a thousand grains of water at the temperature we have agreed upon. The stopper of the bottle has a hole through which the contents can escape when the stopper is driven home.

A BOTTLE OF WATER, AND WHAT IT CAN TEACH US

Supposing we want to measure the specific gravity of some small shot, we can take a given weight of the shot and put it into such a bottle already filled with water. The volume of water that escapes from the bottle in order to make room for the shot is exactly the same as the volume of the shot inserted. All we have to do is to weigh the water that escapes and compare it with the weight of the shot. Suppose the shot weighs eleven times as much as the

water of the same volume, then the specific gravity of the shot would be eleven. This would be just about the figure if the shot were made of lead.

Or, again, we could fill such a bottle as this with ether, and then weigh the amount of ether that we could get into it. We should find the bottle that held a thousand grains of water would only hold about 715 grains of ether, so that the specific gravity of ether is .715, if we call the specific gravity of water 1. It is often very convenient to use 1,000 for the specific gravity of water instead of 1, and then we can say that the specific gravity of ether is 715, that the specific gravity of milk is about 1,030—it should not be less—and that the specific gravity of healthy blood is 1,055, and so on.

DIFFERENT THINGS COMPARED AS TO THEIR BULK AND WEIGHT

Here is a table which shows us the specific gravities of some important substances as compared with the specific gravity of water counted as 1. We shall readily understand that those things which possess a specific gravity higher than 1 will sink in water; while those, such as ice, for instance, which have a specific gravity less than 1 will float upon water; but the nearer the specific gravity is to that of the water, the greater is the amount of the thing which must be immersed in water before it can float. Here is the list:

SOLIDS

Platinum (rolled)	22.1	Diamonds	3.5
Gold	19.3	Marble	2.8
Lead	11.4	Aluminium	2.7
Silver	10.5	Ice	0.9
Iron (wrought)	7.8	Potassium	0.9
" (cast)	7.2	Lithium	0.6
Tin	7.3	Cork	0.2

LIQUIDS

Mercury	13.59	Sea-water	1.03
Sulphuric acid	1.85	Petroleum	0.84
Blood	1.05	Alcohol	0.79
Milk	1.03	Ether	0.71

Gases, of course, have their own specific gravity, just as solids and liquids have. In this case we usually take the gas hydrogen, which is the lightest of all, and we state the specific gravity of other gases by comparison with it. Sometimes air of a certain temperature is taken, but it is better to take hydrogen. If, now, we call the specific gravity of hydrogen 1, then that of oxygen is 16, and that of the mixture of gases we call the air is about 14.4; in other words, hydrogen is only about one-fourteenth part as heavy as air, though, of course, if we want to make this statement a precise one, it is necessary to state the exact composition of the air with which we compare it.

WHY A BALLOON GOES UP, BUT WILL NOT GO UP FOR EVER

We can now understand why a balloon filled with hydrogen will rise in the air; we can also understand that there will be a point beyond which it cannot rise, because the air becomes less dense as we pass upwards in it. In other words, the specific gravity of the air is lowered, and there comes a point when it can no longer do more than just sustain the balloon, even though the balloon is filled with hydrogen.

This is all we need say here about the specific gravity of gases, but we must note a few of the facts which are suggested in the table of solids and liquids. We notice the great weight of various metals, and also that one of them, though liquid, ranks high in specific gravity, even when compared with solids. This liquid metal is mercury. There is no other liquid which at all approaches it in specific gravity.

All the metals are by no means very heavy. Potassium and lithium, for instance—metals we seldom see in their pure state outside a laboratory—have a specific gravity of less than 1, which means that they will float upon water. Just above them in the table, we notice ice, and remind ourselves that water, when it is cooled to freezing-point from 4 degrees centigrade, expands, and therefore its specific gravity becomes less.

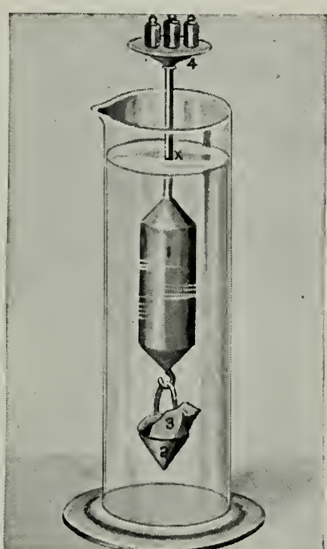
THE GREAT VALUE OF ALUMINIUM, THAT IS BOTH STRONG AND LIGHT

Perhaps after the case of ice, the most important of the specific gravities noticed here is aluminium. This is also a metal, but very much lighter than any of the metals in ordinary use. We have only to compare it with iron, and remember that aluminium is a strong thing, to see that its extreme lightness must be of great practical importance.

There are some interesting points in the list of liquids. We have already referred to the case of mercury, and we note the astonishing difference between this liquid metal—the only metal liquid at ordinary temperatures—and all the

other liquids. Several of the specific gravities noticed in this list are of great importance in testing the purity and the composition of various things. In the official book that gives instructions to chemists, for instance, they are told that such things as ether or sulphuric acid, employed by them, must have such and such a specific gravity. The simple method of using a hydrometer provides us with an easier and quicker test of purity than any other.

When we compare milk with blood, we notice that milk, which is made by the body from blood, is slightly more watery. It is one of the most important duties of the body to keep the specific gravity of the blood at a constant level. None of the processes with which the blood is concerned can proceed properly unless its specific gravity is constant. If a person goes without water, fluid has to be drawn into his blood-vessels from the tissues around them, in order that the blood shall not become too dense. If, on the other hand, a person takes a great deal of water, this is not allowed to make his blood more watery than it ought to be, and all the resources of his body are immediately brought into action—not in a few hours, but in a minute or two—to get rid of the excess of water as quickly as possible. For this purpose, the lungs, the kidneys, and the skin are all available.



The hydrometer consists of a hollow cylinder (1) that floats in water, and is balanced upright by a heavy pan (2) in which is placed any object (3) whose specific gravity is to be measured. The object is first weighed out of water and then in water by putting weights on the platform (4) to make the upright stem sink to a standard mark (x). From these weights the specific gravity can be calculated.

If the individual to whom the excess of water is given is producing milk, then, in such a case, the glands that are producing the milk are pressed into the service of the body for the purpose of getting rid of the excess of water. In France there was not long ago an interesting prosecution of a cow-keeper who made his cows drink enormous quantities of water, thereby greatly increasing their output of milk, but, of course, greatly lowering its specific gravity and its food-value. It is for detecting such things that the hydrometer and the principle of specific gravity are so useful.

Of course, a very interesting question arises, whether we can accuse the man of watering his milk who puts the water into the cow instead of pouring it into the milk-pail. It is the business of the law to say that you shall not sell as milk anything which has less than a certain specific gravity. This has its difficulties, too. The specific gravity must not be made too high, for we must allow for the natural variations which neither the cow nor its owner can help; then, if we keep the specific gravity down, the dairyman will probably take good care to sell no milk of any higher specific gravity. When the cow produces a rich milk, he will water it down till it is still just within the requirements of the law. This shows that the making of perfect laws is a very difficult thing. Lastly, we must refer to the specific gravity of sea-water, which is just about the same as that of milk, but slightly less than that of the blood of the higher animals. This is interesting for two reasons. The history of living creatures teaches us that all life began in the sea. The correspondence between the fluids of our bodies and sea-water to-day is very interesting. It applies not only to their specific gravity but also to the nature and proportion of the salts they both contain.

The other point about the specific gravity of sea-water is the manner in which it affects the art of swimming. Swimming and flying are both practical problems which depend upon specific gravity. The higher the specific gravity of the atmosphere, the easier it is to fly; the higher the specific gravity of water, the easier it is to swim.

THE NEXT PART OF THIS IS ON PAGE 3883.

DOWN AMONG THE WATER-BABIES

There were two kind fairy sisters who looked after the water-babies. One was Mrs. Bedonebyasyoudid and she was ugly and would remain ugly until people behaved well. The other was Mrs. Doasyouwouldbedoneby, and she was ever so pretty. She kissed and cuddled Tom at first, but once when she came she wouldn't pet him, as he had grown rough and was beginning to grow a prickly skin, the reason for which will soon appear.

THE STORIES OF CHARLES KINGSLEY

WE have read Kingsley's best-known novel, "Westward Ho!" and we are now to read a story of a very different kind, also written by him. "The Water-Babies" is a fairy story, and something more. It is an attempt to teach us a great deal about nature and human life and character in the form of a fanciful story. Fairy tales are not supposed to have "morals," and that is where Kingsley's story is different from other fairy tales; but here we are chiefly concerned with the story, which is an extremely pretty one. "The Water-Babies" was originally written to amuse and instruct one of the author's own children, a little boy, and it has entertained multitudes of children, old and young, since it was first printed.

THE WATER-BABIES

BEING A FAIRY TALE FOR A LAND-BABY

CONTINUED FROM 3719

ONCE upon a time there was a chimney-sweep, and his name was Tom. He was ten years old and he lived in a great town in the North Country, where there were plenty of chimneys to sweep, and lots of money to earn for his drunken master. It was in the days when little boys were employed to go up the chimneys and clean them out. Little Tom had never been taught to read or write, and he was as ignorant and as dirty as a boy could possibly be. He never even washed himself. Altogether, he lived a very miserable and hopeless life in the dirty house of Mr. Grimes, the sweep.

One day Mr. Grimes was sent for by Sir John Harthover to come to his fine mansion, Harthover Place, and clean all the chimneys there. Mr. Grimes was so delighted at this fine job that he expressed his joy by knocking Tom down and drinking twice his usual quantity of beer that night.

They were up very early next morning, and Tom's master knocked him down again, just to remind him that he was expected to be an extra good boy that day. On the way to Harthover Place, Mr. Grimes riding on his donkey and poor Tom trudging behind with the brushes, they came upon an old Irishwoman, limping slowly along and carrying a heavy bundle. Although it was not yet five o'clock in the morning, she already seemed to be footsore and weary, so that even the heartless Grimes went so far as to offer her a lift beside him on his donkey. She declined this invitation, saying she would sooner walk with Tom. Grimes growled in reply that she might do as she pleased, and went on smoking.

As Tom and the Irishwoman went along, she asked him many questions about himself, and seemed very sad when he told her that he knew no prayers to say. She told him that she lived far away by the sea, and that although it rolled and roared on winter nights it lay still on the bright summer days, so that the children could bathe in it. Her stories of the sea were so wonderful to poor little Tom that a great longing to look upon it sprang up in him. He, too, would like to bathe and be clean.

When, at length, they came to a spring, near which the Irishwoman and Tom picked some flowers, Grimes got off his donkey, to refresh himself by dipping his head in the water. Because Tom followed his example, his master was displeased with him, and immediately thrashed him again.

"Are you not ashamed of yourself, Thomas Grimes?" said the Irishwoman, when he was belaboring Tom.

Grimes looked up, startled at her knowing his name; but his only answer was: "No; nor never was yet," and he went on beating Tom.

"True for you. If you ever had been ashamed of yourself, you would have gone into Vendale long ago."

"What do you know about Vendale?" shouted Grimes; but he left off beating Tom.

"I know about Vendale and about you, too. I know, for instance, what happened in Aldermire Copse by night, two years ago come Martinmas."

THE LAME IRISHWOMAN WHO MYSTERIOUSLY DISAPPEARED FROM SIGHT

At this, Grimes, who had been growing so angry that Tom was afraid he might strike the poor Irish woman, was so cowed by her words—for she evidently knew something for which he could have been imprisoned—that he got on his donkey again without saying anything more. As they neared the great iron gates at the end of the splendid avenue that led to Harthover Place, the Irishwoman took her leave of Grimes and Tom, by disappearing before their eyes, after she had said:

"I have one more word for you both; for you both shall see me again, before all is over. Those that wish to be clean, clean they will be; and those that wish to be foul, foul they will be. Remember!"

After this we may suppose that Mr. Grimes was in none too good a temper when he arrived at the mansion, where nearly all the inmates, except a few of the servants, were still asleep. There were a great many chimneys to be swept, and due preparations had been made for this, the carpets of the rooms that needed attention being covered over with brown paper round the fireplaces.

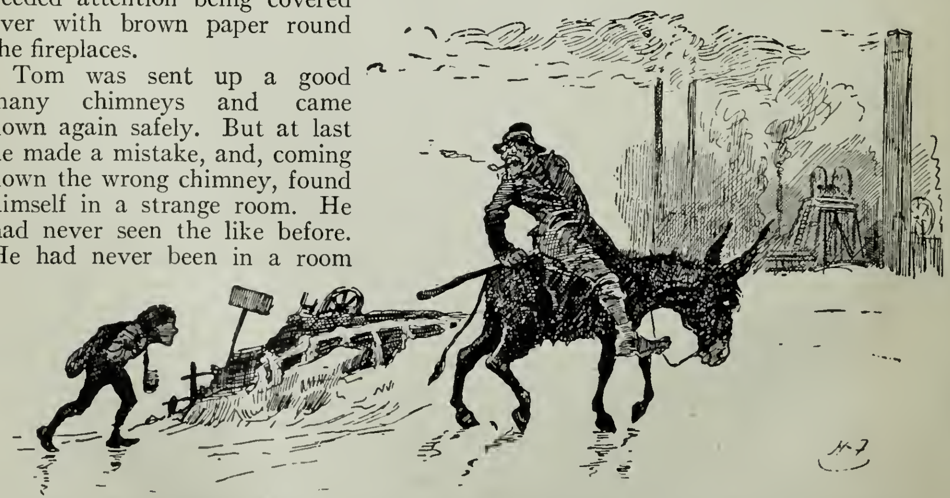
Tom was sent up a good many chimneys and came down again safely. But at last he made a mistake, and, coming down the wrong chimney, found himself in a strange room. He had never seen the like before. He had never been in a room unless it were covered over with dust-cloths and paper, so that he stood bewildered in this prettiest of bedrooms, where everything was white. There were white window-curtains, white bed-curtains, white furniture, and white walls, and just a few lines of pink here and there. There was a washhand-stand, with ewers and basins, and soap and brushes and towels; and a large bath full of clean water. What a heap of things—all for washing!

"She must be a very dirty lady," thought Tom, "to want as much scrubbing as all that. But she must be very cunning to put all the dirt out of the way so well afterwards, for I don't see a speck about the room, not even on the very towels."

Just then he happened to look towards the bed, and there lay the most beautiful little girl Tom had ever seen. He wondered whether all people were as white as she when they were washed. He felt certain that she could never have been very dirty at any time. Thinking of this, he tried to rub some of the soot from his own wrist, and thought, perhaps, he might look better himself some day if he were clean.

WHAT HAPPENED TO TOM IN THE PRETTY BEDROOM, AND WHY HE FLED

Suddenly, looking around, he saw standing close to him a little, ugly, black, ragged figure, with bleary eyes and grinning, white teeth. His first impulse was to drive this little black ape away from the clean room of the sweet



GRIMES, THE CHIMNEY-SWEEP, SETS OUT FOR HARTHOVER, WITH TOM TRUDGING BEHIND.

Poor Tom came down the wrong chimney and found himself in the prettiest bedroom in the world, where the loveliest little girl slept. He was horror-stricken and ashamed when he saw himself in a mirror and discovered how dirty he was. In hastening back to the chimney he made such a noise with the fender that the girl awoke and called her nurse, who came into the room; and thus began Tom's wonderful adventures.

little lady; but when he looked again, and found it was his own reflection in the mirror, he was so overwhelmed with shame that he hurriedly turned to the chimney again to make his escape.

In doing so, however, he upset the fender with such a clatter as to waken the little girl. On seeing Tom, she screamed loudly, and her nurse came running in, just in time to catch him by the jacket. But he was able to wrench himself away, and jumping from the window into a tree close by, he slid down to the ground and ran off across the park, while the nurse very stupidly continued to scream "Murder!" and "Fire!" at the open window.

Now began a most exciting chase. Surely there never was a dirty little boy pursued at once by so many different people. The under-gardener, the dairy-maid, the groom, the steward, the ploughman, the keeper, Grimes, and even Sir John himself, all took part in the chase after Tom. The Irishwoman joined in it too, and, curiously enough, although she had seemed to be so lame on the highway earlier in the morning, she was now the only one that Tom could not shake off. Perhaps this was because he did not see her!

He had gained the high and open moor behind Harthover, and down in a narrow green valley he could see a cottage and a garden. His mind was so excited with all the events of the morning that he fancied he could climb down into the garden in five minutes. But the cottage was really a mile away, and a thousand feet below him. Little Tom, however, was brave enough to make the long and dangerous descent down the face of the hill, and all the time the Irishwoman, whom he did not see, was following him.

When, at length, he managed to reach the cottage, the door of which was all hung round with clematis and roses, he peeped in, half afraid. There, by the empty fireplace, which was filled with a pot of sweet herbs, sat the nicest old woman that ever was seen, in a red petticoat and short dimity bed-gown,

and a clean white cap, with a black silk handkerchief over it, tied under her chin. At her feet sat the grandfather of all the cats, and opposite her, on two benches, sat twelve or fourteen neat, rosy, chubby little children, learning their Criss-cross row, and gabble enough they made about it, to be sure.

TOM'S PLUNGE INTO THE RIVER, AND HOW HE BECAME A WATER-BABY

When Tom ventured to step into the cottage, his dirty little figure caused a great commotion among the chubby little children. At first the old woman would have turned him out, but when Tom pleaded that he was faint for lack of food and drink, her kind heart was touched, and, giving him some bread and milk, she took him to an outhouse where, on some soft hay, he could rest quite snugly. She promised to come to him an hour later, when school was over, and then left him.

Tom did not fall asleep at once, for he could hear the pleasant noise of the stream that ran close by, and, as he lay, half asleep and half awake, the thought that rose uppermost in his mind was: "How to be clean." People would never let him enter any decent place in his dirty state; he could never see inside a church—and he wished very much to see inside one—unless he were cleaned. "I must be cleaned, I must be cleaned," he kept saying aloud; and, half awake, he found himself out of the house and in the meadow, making for the stream, where, pulling off his ragged clothes, he plunged into the cool water.

Just before Tom had taken this cold plunge, the Irishwoman had stepped into the stream and changed into the most beautiful of fairies underneath the water. For she was, indeed, the Queen of the Water-Fairies, who were all waiting to receive her the moment she came back from the land-world.

WHY SHOULD THERE NOT BE WATER-BABIES AS WELL AS LAND-BABIES?

She told them that she was bringing a new brother to them, but, as he was still quite a little savage, and needed to be taught good conduct, he was not to see or know them for some time, though they were to watch over him and see that he came to no harm.

Meanwhile, of course, the chase after Tom had come to an end, although Sir John and his keepers made a second search the next day, as he felt sorry for the little sweep, and was afraid he might have fallen over some of the crags. The old dame at the cottage found he had vanished at the end of the hour, and, for a moment, was inclined to doubt the truth of his story; but when Sir John and the keepers arrived at her house, she knew that Tom had told the truth. They found the little fellow's rags by the side of the stream, and they also discovered his body in the water, and buried it over in Vendale churchyard, where the old dame used to go on Sunday to place flowers on the little grave. They were quite certain that Tom was dead.

But all the time Tom was swimming about in the stream, although he was now only about four inches long, with a set of external gills, just like those of an eft. The fairies had transformed him into a water-baby, and the body that had been found and buried was only the disused shell of him. There are land-babies, and why not water-babies? Some people tell us that water-babies are contrary to nature, but there are so many things in nature which we don't expect to find that there may just as well be water-babies as not.

TOM'S EARLIEST ADVENTURES AMONG THE CREATURES OF THE WATER-WORLD

Tom was extremely happy swimming about there in the river. He had even forgotten that he used to be so dirty. But he remembered how much he had been overworked in the land-world, and meant to make up for it by having nothing but holidays in the water-world for a long, long time to come.

He was still as mischievous as any land-baby, and made himself a perfect nuisance to the other creatures of the water, teasing them as they went about their work, until they were all afraid of him, and got out of his way, or crept into their shells; so that he had no one to speak to or to play with.

It was from a dragon-fly that he learned some valuable lessons in good conduct. For all his short sight, the dragon-fly had noticed a great many interesting things in nature, about which Tom knew nothing, and of which he heard with wonder. One day he might have been eaten by an otter, which was fully under the impression that Tom was only a common eft; but, behold, seven little terrier dogs rushed

at the otter, and drove her off, much to Tom's relief, though he did not guess that these were really water-fairies sent to protect him.

But before the otter had been headed off by the approach of the water-fairies, she had twitted Tom with being only an eft, and told him he would be eaten by the salmon when they came up from the sea—the great wide sea. Tom himself decided he would go down the stream, and discover what the great wide sea was like. On the way he met a great many salmon coming up, and warned them against the wicked old otter who had boasted to him that the otters were the lords of the salmon, and found them good to eat.

One night he saw men spearing the salmon, and some other men set upon them. There was a fight on the bank of the stream, and a man fell into a deep pool, and sank to the bottom, where he lay. Tom recognized him as his old master, Grimes. He expected him to turn into a water-baby, as he had done himself; but there he lay quite still at the bottom of the pool, and never went poaching salmon any more.

Every creature in the stream seemed to be hurrying down to the sea, and Tom, being the only water-baby among all the squirming eels and the scores of different things, big and little, we may guess that he had many strange adventures before he came to the sea. But great was his disappointment to find no water-babies there to play with, though he asked the sea-snails, and the hermit-crabs, and the sun-fish, and the bass, and the pollock, and the porpoises. But though one fish told him that he had been helped the previous night by the water-babies, Tom could find no trace of them at all.

We are to remember that, although he was a water-baby, he was also amphibious, which means that he could live on the land as well as in the water; so that at nights he took to playing about

THE FRIGHTFULLY WISE OLD PROFESSOR AND THE WATER-BABY

One day little Ellie was at the seashore with a frightfully wise old professor, who said there were no such things as water-babies. Just then he caught one, and it was Tom! But the professor wouldn't admit it was a water-baby, and when Tom escaped from him, Ellie tried to catch him, but slipped and injured herself.

among the rocks on the seashore, and there, one day, a funny thing happened to him. Lady Harthover, whose little daughter Tom had frightened the day he came down the wrong chimney, had come down to stay at the seaside with Ellie for a vacation. The little girl often went for walks along the shore with a very kind, good-natured, little, old gentleman, named Professor Ptthmllnsprcs, which is a very ancient and noble Polish name. He was professor of Necrobioneopalaeonthydrochthomanthropopithekology in the university which the King of the Cannibal Islands had founded, and had come to collect strange specimens from the seashore.

Little Ellie believed there were water-babies, but the frightfully wise old professor assured her that such ideas were all nonsense, although, after he had entered into long explanations which explained nothing, all he could say in reply to Ellie's question, "Why are there no water-babies?" was "Because there ain't," which was neither very grammatical nor very polite.

HOW TOM WAS CAUGHT IN A NET, AND HOW HE ESCAPED AGAIN

Just as he said this, he was groping with his net among the seaweed, and caught Tom in the meshes.

"Dear me!" he cried. "What a large pink Holothurian; with hands, too! It must be connected with the Synapta." And he took him out.

"It actually has eyes!" he cried. "Why, it must be a Cephalopod! This is most extraordinary!"

"No, I ain't!" cried Tom, as loud as he could; for he did not like to be called bad names.

"It is a water-baby!" cried Ellie; and of course it was.

"Water-fiddlesticks, my dear!" said the professor; and he turned away sharply. But there was no denying it. It was a water-baby; and he had said, a moment ago, that there were none. What was he to do?

It was, in a way, fortunate for the professor that, when he poked Tom with his finger, the water-baby bit him so smartly that he was glad to drop him on to the seaweed, whence Tom dived into the water, and was gone in a moment. Little Ellie, in her desire to have the pretty little water-baby, tried to catch Tom before he disappeared into the sea, but, slipping on the rocks, she hurt herself so badly that she had to be carried away and taken home, where one night the fairies came along the moonbeams, bringing with them a pair of wings, with which beautiful little Ellie flew away in their company.

TOM HAS AN EXCITING TIME WITH HIS FRIEND THE LOBSTER

Now, when Tom had been picked up by the professor, he had recognized little Ellie, and wished so much that she could have been his playmate. But soon, as he was going along at the bottom of the sea, he came across a poor old lobster, with whom he had been friendly, caught in a lobster-pot. He tried to help him out, in doing which he nearly came to grief from the otter, who came along and accused him of having warned the salmon against her.

As it was, however, the otter got the worst of it in the fight that took place between the lobster and herself in the lobster-pot; and Tom was afraid his friend the lobster was going to be caught, when he saw the pot being pulled up. He escaped from it himself in time, and was delighted to see the lobster manage to snap away from it at the last moment, even at the cost of leaving one of his claws behind him, which, of course, was only a temporary inconvenience, as it would grow again.

And now a most wonderful thing happened to Tom, for he had not left the lobster five minutes before he came upon a water-baby. A real live water-baby, sitting on the white sand, very busy about a little point of rock. And when it saw Tom it looked up for a moment, and then exclaimed with delight: "Why, you are not one of us! You are a new baby! Oh, how delightful!"

TOM MEETS OTHER WATER-BABIES AT LAST

And it ran to Tom, and Tom ran to it, and they hugged and kissed each other for ever so long: they did not know why. But they did not want any introductions there under the water.

At last Tom said: "Oh, where have you been all this while? I have been looking for you so long, and I have been so lonely."

"We have been here for days and days. There are hundreds of us about the rocks. How was it that you did not

see us or hear us when we sang and romped about the rocks and sand every evening before we went home?"

Tom looked at the baby again, and then he said:

"Well, this is wonderful! I have seen things just like you again and again, but I thought you were shells or sea-creatures. I never took you for water-babies like myself."

Now, was not this very odd? So odd, indeed, that you will, no doubt, want to know how it happened, and why Tom could never find a water-baby till after he had got the lobster out of the pot. But if you will read this story nine times over, and then think for yourself, you will find out why. It is not good for little boys to be told everything and never to be forced to make use of their own wits.

"Now," said the baby, "come and help me, or I shall not have finished before my brothers and sisters come, and it is now time to go home."

"What shall I help you at?"

"At this poor, dear little rock. A great clumsy boulder came rolling by in the last storm, and knocked its head off and rubbed off all its flowers. And now I must plant it again with sea-weeds, and coraline, and anemones; and I will make it the prettiest little rock-garden on all the shore."

So they worked away at the rock and planted it, and smoothed the sand down round it, and capital fun they had till the tide began to turn. And then Tom heard all the other babies coming, laughing and singing and shouting and romping; and the noise they made was just like the noise of a ripple. So he knew he had been hearing and seeing the water-babies all along, only he did not know them, because his eyes and ears were not opened.

And in they came, dozens and dozens of them, some bigger than Tom, and some smaller, all in the neatest little white bathing-dresses; and when they found that he was a new baby, they hugged him and kissed him and then put him in the middle and danced round him on the sand. And there was no one ever so happy as poor little Tom.

He gaily swam away with them to their home in the caves beneath St. Brandan's fairy isle; but he was still a naughty little water-baby, given to amusing himself by tormenting the anemones, the crabs, and other odd creatures of the sea, and paying no heed to the warning of the water-babies, who said: "Take care what you are at, as Mrs. Bedonebyasyoudid is coming back."

Tom grew prickly all over just because he did things for which his conscience pricked him, and he was sent to be taught by Ellie, the new water-baby, how he might become smooth again by giving up his bad habits and being kind to others.

Early one Friday morning this tremendous lady indeed came, and when the water-babies saw her they all stood in a row, and smoothed down their bathing-dresses, and put their hands behind them, just as if they were going to be examined by an inspector.

Mrs. Bedonebyasyoudid was very ugly, and had a pair of large green spectacles on her great hooked nose. But she was very good to the water-babies, and gave them all some sea-sweets because their conduct had pleased her. Tom was very much disappointed when it came to his turn, as she popped a nasty, cold, hard pebble in his mouth, at which he began to whimper. So she reminded him that he had been cruel to the anemones by dropping pebbles into their mouths and making them think for a

moment that they had caught a good dinner.

"As you did to them, so I must do to you," said Mrs. Bedonebyasyoudid. She also told him that it was quite useless for him to try to hide his actions from her, as she knew everything that the water-babies did, and could not help punishing those who did wrong.

WHAT TOM WAS TOLD BY MRS. BEDONEBYASYOUDID

She told him, too, that she was the ugliest fairy in the world, and would have to remain so until people behaved themselves properly, when she would grow as beautiful as her sister, Mrs. Doasyouwouldbedoneby.

"Now all of you run away, except Tom," she said; "and he may stay and see what I am going to do. It will be a very good warning for him to begin with before he goes to school."

Then she called up all the doctors who had given little children too much physic, and she made them take their own medicines, such as salts and senna, and brimstone and treacle, to say nothing of pulling out their teeth. Then she called up all the careless nurse-maids, and stuck pins into them all over, and wheeled them about in perambulators, with tight straps across their stomachs and their heads and arms hanging over the sides. After luncheon she punished all the cruel schoolmasters, and altogether she had a very exciting and exhausting day. All this had to be done every Friday, so we can see that her job was by no means an easy one. But people cannot always choose their own professions.

It was on Sunday that the ugly fairy's beautiful sister visited the water-babies, who were all delighted to see her.

HOW TOM WAS STRANGELY PUNISHED BY HIS OWN CONSCIENCE

To Tom in particular she was very kind, and petted him a great deal; but this did not make him a better water-baby, for he had now grown so fond of the sweet things Mrs. Bedonebyasyoudid kept in a secret store, that he searched out her hiding-place and ate as many as he could.

Of course the fairy knew what he had done, but she was more sorry than angry with the little fellow, and said nothing about it next time, giving him his share with the rest. She left it to his conscience to punish him, and that did its work, in a very curious way. When Sunday had come round again, and Mrs. Doasyouwouldbedoneby had come back, Tom was very anxious to be petted and cuddled by the beautiful fairy, but she said she could not do so, for, since her last visit, he had grown horny and prickly all over his body. And it was as she said. Just as his conscience had been pricking him on account of his wrong-doing, his body, too, had become as prickly as some of the sea-shells.

Tom could now see that the best thing to do was to confess to Mrs. Bedonebyasyoudid next Friday, and leave her to deal with him. This she did very gently, forgiving him for his naughtiness, and promising to send him a schoolmistress who would teach him how to get rid of his prickles. Who should this schoolmistress prove to be but little Ellie, who was now one of the most beautiful of the water-babies, and she came to know by-and-by that her little pupil had been the chimney-sweep who frightened her ever so long ago.

TOM'S WONDERFUL JOURNEY TO THE OTHER-END-OF-NOWHERE

For seven whole years they studied together, but as Ellie always went away on Sundays and Tom wondered where she was, he grew discontented, and said she was tired of him. He had more reason to be discontented when she disappeared altogether, and Mrs. Bedonebyasyoudid told him it was she who had sent Ellie away. She also showed him "The History of the Doasyoulikes," people who had come away from the country of Hardwork, and what happened to them was certainly enough to frighten poor Tom.

In his new desire to win the good opinion of Mrs. Bedonebyasyoudid, he said he was ready to go to the world's end to find his old master, Mr. Grimes, who, the fairy said, was now at the Other-end-of-Nowhere. In order to get there he had first to go to Shiny Wall, and then through the White Gate that was never opened, on the way to Peacepool and Mother Carey's Haven, where the good whales go when they die. If he ever got there, Mother Carey was to tell him how he could reach the Other-end-of-Nowhere, and find Mr. Grimes. The journey was a very, very long

one indeed. All the way Tom fell in with adventures, but there was always somebody to help him with advice. There was the King of the Herrings, for instance, who showed him the way to the Allalonestone, where he was to find the last of the Gairfowl. In due course he came up to this queer old creature, who was rather like a penguin, sitting on her stone very mournfully. She told Tom her sad story, at the end of which she wept tears of pure oil, and confessed that her poor old brains were getting quite puzzled. She really did not know the way to Mother Carey's Haven at all. But a flock of petrels came winging along, and, when they heard what Tom was wanting, they said:

"Shiny Wall? Do you want Shiny Wall? Then come with us. We are Mother Carey's own chickens, and she sends us out over all the seas to show the good birds the way home."

Thanks to them, Tom soon reached Shiny Wall, which was really a big iceberg, under which he had to dive and swim for seven days and seven nights in order to come to Peacepool.

TOM FINDS MOTHER CAREY AND ALSO FINDS HIS MASTER UP A CHIMNEY

There, at last, in the middle of the pool, sat Mother Carey, like a gigantic marble statue, on a throne. And from the foot of the throne there swam away, out and out into the sea, millions of new-born creatures, of more shapes and colors than man ever dreamed, and they were Mother Carey's children, whom she makes out of the sea-water all day long.

Mother Carey gave him a pass which he was to keep until he got to the Other-end-of-Nowhere, the way to which she explained to him. It was only after many other strange adventures that he arrived there, and, showing his pass, was admitted into a curious kind of castle. Here he inquired for Mr. Grimes and was told he would find him up chimney No. 345 if he cared to go up on the roof and look for him.

Sure enough he found him there, with his head and shoulders just sticking out of the chimney, and in his mouth a pipe that would not draw. The sweep was grumbling very much, and when he saw Tom he supposed he had only come to laugh at him in his plight; but Tom declared he only wished to help him. Mrs. Bedonebyasyoudid now appeared on the scene, and reminded Grimes that he had often treated Tom as he was now being treated himself. Tom, however, urged her to let him help his old master, and vainly tried to wipe the soot from Grimes's face.

HOW TOM GOT HIS OLD MASTER RELEASED FROM THE CHIMNEY

Tom was so sincerely anxious to help him that his efforts at last softened the hard heart of the master-sweep, who now began to think of the mother he had forsaken in his youth, and he wept over his own wrong-doing. The tears that he shed increased at such a rate that they washed the soot from his face and clothes, and then they washed the mortar away from between the bricks, and the chimney crumbled down, and Grimes began to get out of it.

"Will you obey me if I give you a chance?" said Mrs. Bedonebyasyoudid.

"As you please, ma'am. For I'm beat, and that's the truth," said he.

"Be it so, then—you may come out. But remember, disobey me again, and into a worse place still you will go."

"I beg your pardon, ma'am, but I never disobeyed you that I know of. I never had the honor of setting eyes upon you till I came to these ugly quarters."

"Never saw me? Who said 'Those that will be foul, foul they will be'?"

Grimes looked up, and Tom looked up too, for the voice was that of the Irishwoman who met them the day they went out together to Harthover. She ordered Grimes to march off in the custody of a policeman, who was to see that he devoted himself to the considerable task of sweeping out the crater of Etna!

TOM RETURNS TO ST. BRANDAN'S ISLE AND MEETS ELLIE AGAIN

Tom now returned to St. Brandan's Isle, where he met Ellie, and they were ever so delighted to see each other again. There Mrs. Bedonebyasyoudid came to them, and they tried to guess who she really was; but they did not succeed, and she told them they would know some day. Then, turning to Ellie, smiling, she said:

"You may take him home with you now on Sundays, Ellie. He has won his spurs in the great battle, and become fit to go with you, and be a man, because he has done the things he did not like."

THE NEXT FAMOUS BOOKS ARE ON PAGE 3969.

THE BOATS THAT CATCH THE FISH

Fishing is one of the important British industries, about 100,000 men being engaged in catching the fish at sea, while thousands more are occupied in preparing and selling them on land. The value of the fish landed in the United Kingdom in one year is about $50,000,000, while the weight of a year's catch is equal to 10,000,000 sheep and 1,000,000 cattle. In this picture we see fish being landed at Newlyn, in Cornwall.

Here we see fishing-boats at rest at Mousehole, a little village near Newlyn. The fish caught in the Cornish fisheries are chiefly mackerel and pilchards, and their value in a year is about $350,000. The fisherman's calling is toilsome and dangerous, and in ten years 2,500 men engaged in the British fisheries lost their lives, in one way or another. Four-fifths of the fish landed in England come from the North Sea.

HOW FISH AND OYSTERS ARE TAKEN

CONTINUED FROM 3764

THOUSANDS and thousands of men, and women, too, all over the world are engaged in getting food from the sea for themselves and others. Many thousands of men, women and children are employed in cleaning and preserving the fish. Thousands more work on shore making and repairing boats, nets and fishing tackle, or in preparing boxes and barrels into which the catch is placed. Thousands of boats, large and small, are employed in this operation, and the value of the food brought to shore is many millions of dollars.

From the earliest times men have eaten fish. All savages who live near the water eat fish, and some are very skilful fishermen. In Bible times there were many fishermen, who fished with nets and with hooks, but chiefly with nets. All through history we find stories of fishermen and their work. At the present time the world gets a great part of its food from the waters, both salt and fresh.

The fishing of Great Britain and Ireland are the most important, in proportion to the number of people. These islands are washed by the sea on every side, and some of the best fishing grounds in the world are in easy reach. The United States comes first in the value of fish caught, and the fisheries of Russia, Canada, France, Norway, the German Empire, and Japan are also important. Every country which has a seacoast will have fisheries as a matter of course.

DIFFERENT FISH IN DIFFERENT PARTS OF THE WORLD

The same kinds of fish do not live in every part of the sea. Some like cold water, which would kill others. Some fish like to go to the warmer waters in winter, but come toward the north in summer. Many fish found in the Atlantic, are not caught in the Pacific, and the converse is also true. Even the fish in different parts of the Atlantic are not alike.

Many fish found in European waters are never seen in American waters, and there are others which belong to America alone. Often the fishes called by the same name in Great Britain and the United States are not quite alike, though they may belong to the same family. Sometimes a fish can be transferred from one sea to another. The shad belongs to the Atlantic, but the United States Bureau of Fisheries has set free millions of young shad on the Pacific and that delicious fish seems to be well established there now. It enters the streams to lay its eggs as far north as Alaska.

ALL FISH HAVE NOT THE SAME HABITS OF LIFE

Some fish live near the surface; others swim far below. Some will bite at hooks, and are caught on lines; others must be taken in nets, some of which are more than a mile long. Then there are oysters, mussels, lobsters and crabs, which are not fish, of course, though they come from the water, and are sold at the fish-market. In other places in our book you may find much about the different fishes and many pictures of them.

The simplest method of catching fish, which one person can use is the hook and line, but it is very slow work, unless the fish are plentiful and very hungry. Men fish with hook and line for sport, but the men who catch fish for market generally use other methods. Men sometimes go out in a boat and throw out several lines, which they draw behind them as the boat moves through the water.

More often the fishing schooners which have gone after cod, fasten a long line to buoys. To this line are fastened hundreds of shorter lines, each with a hook on the end. This is called "setting a trawl." The cod swim along together in great numbers, and sometimes hundreds will be found securely caught when the men go out in a small boat to examine the trawl. They are taken off, and fresh bait is put on the hooks, unless the cod have gone away, and the skipper decides to try his luck elsewhere.

THE FISHERMAN MUST LEARN TO THINK LIKE A FISH

Sometimes the fish will be plentiful, and then, all at once, will vanish from that part of the ocean. Some masters of fishing schooners learn to guess what the fish will do. When the fish cease to bite they go to the place they think the fish will go. Probably the movements of the fish have something to do with their food supply, and this is influenced by currents, temperature and winds. In the story of "Captains Courageous," you learn something of life on one of these schooners. New England is the great deep sea fishing section of the country, and Gloucester is the most famous fishing port, though Boston is the greatest market for fish. The sailing vessels are being replaced by steam vessels now, and the business is not so picturesque as it once was, but there are still many fishing schooners to be seen. There is a fine picture of a fishing schooner on page 5372.

THE DIFFERENT KINDS OF NETS WHICH ARE USED

More fish are caught in nets than by lines. There are many kinds of nets. The pound net is set in shallow water, not far from the shore. Poles are driven down into the bottom to form an enclosure, and a net, shaped like a huge bag with an opening in one side, is set inside. A long net is stretched from the shore to the opening in the net. Fish swimming along, come to this "leader," as it is called, and swim along hoping to get around it. Soon they find themselves in the pound, and are too stupid to get out. Pound is an old English word meaning an enclosure. The fishermen come out in small boats, pull up the net, and take out the fish.

NETS WHICH ARE OVER A MILE LONG

Other nets, called seines, are long lengths of net, with weights on one side and floats on the other. One end is often fastened near the shore, while a boat takes the other out and drops it into the sea. The weights stretch the net toward the bottom, while the floats keep the top from sinking. This makes a wall of net, sometimes more than a mile long. A net so heavy as this cannot be drawn in by a boat. Ropes are attached to the sea end, and are taken to shore and attached to a windlass. The net is now in the shape of a great semicircle, which is drawn to shore, bringing with it whatever fish were within the space over which the net passed. There are other seines which are taken out in boats.

The gill net, or drift net, is often set across a channel or the entrance to a bay. It is like a seine, except that both ends are usually free. Fish try to get through the spaces in the net, and become entangled. When it has been out some time the fishermen go out and take up the net, a little at a time, take out the fish, and drop it back again to catch other foolish fish which try to get through spaces too small for them.

There are other kinds of nets used in various parts of the United States. The shad net is set in a river like the leader of a pound net. The shad trying to get up the river to lay their eggs are entangled in the net, and held fast. Fyke nets are great bags set at the bottom of

the sea. They have mouths shaped like a funnel, and the fish are not wise enough to get out, when they have gone inside.

THE TRAWL IN ENGLAND NOT THE SAME AS IN AMERICA

We have told you that the trawl is a long line to which shorter lines are fastened. In Great Britain the word is used with a different meaning. There it means a great net in the shape of a bag, with a mouth sometimes a hundred feet, or even more, across. This is dragged along the bottom of the sea, and gets especially those fish which live on, or near the bottom, such as soles and flounders, which are not easily caught in other ways. Many cod and haddock are also caught in trawl nets. Such a net can only be used where the bottom is smooth, for a rough bottom would tear the net. The boat which carries one of these nets is called a trawler. Some are sailing vessels, but the large nets require machinery to draw them in, and so the number of steam trawlers has increased. Trawlers bring in three-fourths of the value of all the fish caught in Great Britain.

FISH OF THE PACIFIC AND OF THE GREAT LAKES

The most important fish on the Pacific coast is the salmon, which is little trouble to take. In fact this fish almost begs to be caught, as it goes up the rivers to lay its eggs. However, many of them are caught in nets in the bays. The salmon also takes the hook and puts up a game fight, but it is so easy to take in other ways, that few men fish with hook and line.

The Great Lakes are inland seas in size, even if the water is fresh, and many million pounds of fish are taken from these waters by fishermen from Canada and the United States. The whitefish, the lake herring and the lake trout are the most important varieties. They are taken with gill and pound nets, seines, and with hooks and lines. More are taken in by Canadian than by American fishermen.

HOW OYSTERS ARE RAISED FOR THE MARKET

The oyster fisheries of the United States are worth more than those of all the rest of the world. We show you some pictures of them, but more of the oyster fisheries of Europe. Oysters are scarce there, and they take more pains to rear them than on this side of the Atlantic. For a long time oysters could be gathered from their natural beds so easily and so plentifully that no one thought of taking care of them. But so many oysters are eaten in the United States, and so many are destroyed and wasted in gathering them, that they have begun to grow scarce in some places. Heavy dredges are dragged over the bottom, and bury or break as many oysters as they bring up. The tongs and rakes also do some damage in this way.

Men, therefore, are sometimes allowed to mark out a space in the shallow water in which no one else is allowed to fish. If the bottom is soft they scatter gravel or empty oyster shells over it, and then scatter some full grown oysters for seed, as they say. Since a large oyster may lay as many as 60,000,000 eggs, one would think that they should increase very rapidly. Many of the eggs are eaten by fishes, however, many are carried away by the currents, and many never hatch at all. Those that do hatch swim about for a few days and begin to build a shell. Then, if they have not been eaten, they sink to the bottom and attach themselves to the old shells or stones. If there are none, they sink into the mud and die.

Such a bed as this may be left until the oysters grow large enough for market, but if it is found that a great many have settled down, some of the stones or shells with the young oysters sticking to them may be raked up and dropped in another bed, where they are allowed to grow. If the men who own the beds are careful and do not take out too many oysters, a bed will last a long time, as countless millions of tiny oysters begin their life every year.

You are sure to be interested in the pictures of the French fisheries. Oysters bring such a high price there, that it pays to take a great deal of trouble to raise them. In the United States and Canada oysters are too cheap to make so much care profitable.

If we only had room we could tell you an interesting story of the lobster and crab fisheries of the world. Many of you have seen the lobster pots in the water, and perhaps have seen the fishermen draw them up. Crab fishing in Japan is interesting, too, and much of the catch comes to the United States, but every story must have an end.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 4003.

CATCHING SPRATS OFF THE EAST COAST

In this picture we see a drift-net for sprats being let out from a boat. The net has pieces of cork placed at intervals along the top to keep it afloat, and one end of the net is fastened by a rope to the boat. The boat then drifts, and the fish, swimming against the net, get their heads caught in the meshes and cannot escape.

The net is then hauled in and the boatmen row ashore. Drift nets are used only for fish that swim near the surface of the sea, like mackerel, pilchards, and sprats, and usually several nets are fastened together.

The boat on reaching shore is pulled up on the beach, and the sprats are then shaken out of the nets, ready to be sorted and packed for the market. The pictures on this page show sprat-fishers in England.

PACKING THE SPRATS FOR THE MARKET

Having shaken the sprats clear of the nets, the fishermen measure their catch in large metal cans, as shown in this picture. The fish are now ready to be packed and sent to the markets for which they are intended.

Here we see sprats being packed into boxes, ready for despatch to London. They are carried from the boat to the boxes in the metal pails used for measuring the catch, and when full the boxes are fastened. The quantities of fish caught vary very much, of course, but as many as fifteen tons have been caught in a single day by the nets of one boat. Many of the "sardines" that we buy are really young sprats packed in oil.

A GREAT HARVEST OF HERRINGS

Here we see a catch of herrings being landed on the East Anglian coast. These fish are caught by drift-nets, and they form the principal fishery of the United Kingdom. The value of the herrings landed in a year is equal to about $10,000,000. It is estimated that 2,200,000,000 herrings are landed in Britain in a season.

This great mass of herrings on the quay, waiting to be packed, will give some idea of how many fish are landed at once. Some time ago a single lugger brought to land a quarter of a million herrings, which realized $900, the result of a night's fishing. Herrings are caught principally in the North Sea, where they abound.

MILLIONS OF HERRINGS FOR THE SHOPS

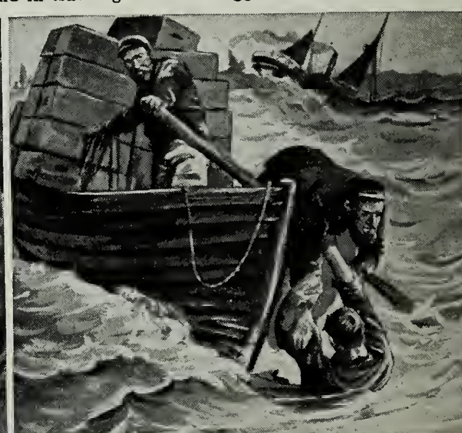
The herrings are landed on the quay, as shown on page 3846; the various sizes are sorted and placed in large tubs, ready to be sent off to London and other large towns. The principal centres of the North Sea fishery are Hull and Grimsby, which have more than $20,000,000 invested in steam-trawlers alone.

Here the herrings are ready for despatch, and there has been an excellent catch. The finest kinds of fish, such as soles, turbot, and brill, as well as haddocks, whiting, and cod, are caught by trawling—that is, by dragging a great net along the bottom of the sea. This can be done because nowhere is the North Sea so deep but that the cross of St. Paul's would show above water if the cathedral stood on the bed of the sea.

TRAWLING-SMACKS & STEAM-TRAWLERS

Of all the British methods of fishing, trawling is the most important, and here we see a fleet of trawling-smacks in the North Sea. It is only since the middle of last century that trawling has come into general use. The word trawl means "to go hither and thither," and in trawling a net is dragged along the sea-bottom.

The finest fish, such as soles, turbot, and brill, are caught by trawling off the English coast. As the net is dragged along the sea-bed the fish are caught in the mouth of the trawl, which is then hauled on deck.



The trawlers remain at sea sometimes for weeks, and their catches are collected by steamers that take the fish to London. Ferrying the fish from trawler to steamer is often dangerous work, as we see here.

Sailing smacks are fast giving place to fine steam-trawlers like that shown in this picture. These vessels are expensive, but can do the work of several sailing boats. One steamer, after towing her trawl-net for only four hours, caught over seven tons of fish. Steam-trawlers began to be used at the end of last century.

FISH IN RIVER AND BAY IN THE EAST

The shad belongs to the herring family but is much larger. Every year they ascend the rivers to lay their eggs. Once they were very abundant, but the rivers have become dirty from the cities and factories on their banks, and so many have been caught that they are now becoming scarce. Nets attached to poles are placed across the rivers. Here fishermen in the Hudson are removing the catch from the net.

You have seen Cape Cod on the map, even if you have never visited that delightful region. This picture was made at North Truro, not far from the tip of the long arm. The soft beach does not injure the bottom of the boat, which has been pulled up on the sand. Provincetown lies beyond and to the left.

Pictures from Brown Bros.

FISHING UPON THE PACIFIC COAST

Picture from Brown Bros.
The fishing industry in the Pacific employs many men. Here we see an old netmaker mending miles of nets upon a wharf at San Francisco. A small break soon spreads and makes a net almost worthless. Nets are made of twine, which must be strong, and must not rot easily, for a net is quite expensive.

The most important food fish of the Pacific is the salmon, about which we have told you in several other places. They are easily caught in several ways. Here is one of the methods used in Oregon, where salmon are caught by the ton. The salmon which frequent Puget Sound and the Columbia River are especially prized for their flavor, and millions of pounds are preserved in tin cans and sent to all parts of the world.

OYSTERS ON THE NEW JERSEY COAST

The United States produces and consumes more oysters than any other country in the world. This boat has been out to the oyster beds off the New Jersey coast, and has returned with a heavy load. The boat cannot go into the shallow water inshore, and the oysters, which you see heaped up, are placed in baskets. These are transferred to flat-bottomed scows, one of which is moored beside the boat.

In the oyster bed the oysters often lie in mud. Now they are dumped in the shallow water at the mouth of the creek, which washes them clean as the tide rises and falls. Then, too, if they are not needed at once they will remain alive here, but would die and become unfit for food if left long out of water. Soon they will be shipped to the city, either with or without their shells. Many thousand bushels are eaten daily.

GATHERING MUSSELS AT LOW TIDE

While mussels are wastefully used as manure on the English coast, large supplies of this shell-fish are imported from Holland and Belgium for food. It is a rather popular food in England, though it is little eaten in America and in Scotland. Here we see a large mussel-bed on the Belgian coast as it appears exposed at low water. In this country and in most European lands mussels are largely used as bait.

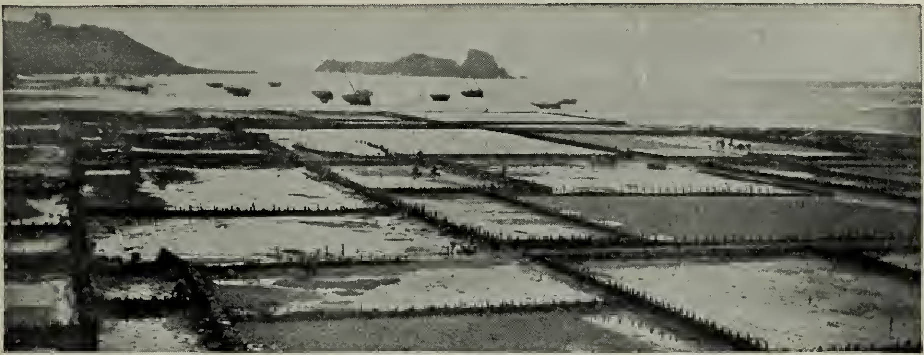
A Belgian woman gathering mussels from a natural bed of this shell-fish, found on a breakwater.

Mussels growing on a piece of wreckage that has been cast ashore and embedded in the sand.

A mussel fisher of the Belgian coast gathering them at low water from the piles supporting a pier.

The people of Holland cultivate artifical beds of mussels, and here we see a Dutch mussel-farmer in his boat, raking them up for market. The Dutch are successful at this artificial mussel-rearing, but it is interesting to know that they get a very large proportion of their spawn, or eggs, from the southeastern coast of England.

AT WORK ON A GREAT OYSTER FARM



On parts of the coast of France, oysters are reared artificially, and here we see, at low water, a corner of the great oyster nursery at Cancale, which is on the north of Brittany, opposite the island of Jersey.

Another famous French oyster fishery is that of Arcachon, on the Bay of Biscay, near Bordeaux. It is visited every year by thousands of strangers, to whom the picturesque oyster-women working in trousers, like men, are a familiar sight. They are here seen gathering the oysters from the beds for the market.

In this picture we see the rearing-cases used at Cancale. The spawn, which is known as spat, and really consists of eggs, is placed in these cases to hatch, and the oysters are kept there till they are six months old.

COLLECTING AND WASHING THE OYSTERS

Many women are employed in the oyster industry at Cancale. Here we see an oyster-gatherer at work.

After they are gathered, and before being packed for market, the oysters are washed in baskets.

On page 3853 we see the rearing-cases where the spat, or spawn, is hatched. When the oysters are six months old they are removed, as is being done by the men in this picture, and placed in the oyster-beds.

Here the oysters are receiving a final washing before being packed. They are plunged up and down in the water and shaken in the cleansing-baskets.

At last, when the cleansing is complete, the oysters are put in square baskets, like the one seen in this picture, and wheeled on trucks to the packing sheds.

THE NEXT FAMILIAR THINGS ARE ON PAGE 4003.

A vast and desolate sea of sand in the Arabian desert, stretching as far as the eye can see.

PERSIA AND ASIATIC TURKEY

THE LANDS OF THE SULTAN AND THE SHAH

CONTINUED FROM 3806

WE already have some idea of the vastness of Asia, the huge continent four times the size of Europe. For in the story of India we have glanced at the majestic Himalayas, whose four chief peaks top all the other white-capped giants of the world; and in the story of Russia we have seen the stormy Caspian, the largest inland sea in the world. We have felt, too, the chill of the coldest climate in the world as we traveled, in imagination, by the longest railway in the world, from the Urals to the Pacific.

Let us now turn to the south-western part of the continent, girdled by the Caspian, the Black, the Mediterranean, and the Red seas, the Persian Gulf and the Indian Ocean. The mass of land thus bounded takes in the western peninsula of Asia Minor, whose northern shores approach within sight of Europe; Syria, bordering the extreme east end of the Mediterranean; the immense southern peninsula of Arabia, between the Red Sea and the Persian Gulf; Mesopotamia, the country lying in the valleys of the two great rivers, the Euphrates and the Tigris; and Persia, between the Caspian and the Indian Ocean. The land frontiers of Persia march with the old Russia on both sides of the Caspian, with those of Afghanistan and Baluchistan, two states on the borders of India, and with what was the Turkish Empire on the west.

Asia Minor, Syria, Mesopotamia, and a part of Arabia formed until after the Great War the Asiatic dominions of Turkey and are about one-fifth the size of our own country. Persia is an independent kingdom, one of the oldest in the world, and is about three times as large as France. Turkey now has no authority over Palestine, Arabia or Mesopotamia. Several self-governing states have been set up in Arabia, and Mesopotamia and Palestine are to be under British supervision, though they are not to become parts of the British Empire.

How long ago this part of Asia was first peopled no one can tell. Some say the Garden of Eden was watered by its chief river, the Euphrates. On one of its heights, Mount Ararat, within the present Armenia, but near the borders of Persia, the Ark of Noah is said to have rested. The Tower of Babel is said to have risen towards heaven from the plain of Mesopotamia.

It was from his home in a city of Mesopotamia, near the Persian Gulf, that the patriarch Abraham, the founder of the Jewish faith, wandered forth at God's bidding. He led his flocks and herds in search of pasture across the narrowest part of the Syrian desert, which joins that of

Arabia, till he settled in Palestine, or Canaan, whence his descendants, carrying with them the old faith and its customs, have spread all over the wide world. Abraham's country received yet another name in after years—the Holy Land; for here, some twenty-four centuries after Abraham slept in his ever-shifting tent under the brilliant, starlit sky, Christianity was founded in the great days of the Roman Empire. Here was born, and lived, and labored, and here died, Jesus Christ; and for nearly 2,000 years pilgrims have visited, with deep interest and devotion, the scenes of His early and lowly life at Bethlehem, at Nazareth, at Jerusalem, and other places.

SOUTH-WESTERN ASIA, WHICH WAS THE CRADLE OF TWO GREAT RELIGIONS

His disciples carried His teaching through some of the provinces of Asia Minor and round its Mediterranean coasts, where the wavy shores and countless islands have just the same soft beauty as those of Greece across the Archipelago. From Greece the religion of Christ spread to Rome; from thence over the world; and, in the chapters of the Bible, men of all races have become familiar with the various features of Palestine, with the desolate salt lake known as the Dead Sea—nearly 1,300 feet below the level of the Mediterranean—the River Jordan, and the shining Lake of Galilee among the hills.

The third of the great world religions that have sprung from South-western Asia arose about 600 years after Christ, from Arabia, when Mohammed, the camel-driver, a man of immense personal power and enthusiasm, announced his message: "There is but one God, and Mohammed is His prophet." His teaching soon spread far and near, and South-western Asia has remained ever since so much the heart and centre of Mohammedanism that the history of its countries is closely bound up with the history of the progress of that religion.

THE NARROW CHANNEL THAT SEPARATES EUROPE FROM ASIA

But before going into that history, let us take a rapid glance over the surface of the lands that are so interesting to lovers of ancient life, and to Jews, Christians, and Mohammedans alike.

Shall we start from Constantinople, the capital of the Turkish Empire, in which Europe and Asia meet? As we know, it is but a short ferry across the Bosphorus to its Asiatic suburb of Scutari, which stands on the same rocky mass as Stamboul in Europe, with but a narrow cut between, by which the waters of the Black Sea pass to the Mediterranean.

If we could sweep over this part of the country in a flying machine, we should see that the ridges of mountains encircling the central plateau of Asia Minor have many points in common with the mountains of the Balkan peninsula, the mountains which caused so much isolation in former days. Let us note the deep, marshy plains near the blue sea, separated by shaggy mountains, the rivers running in deep gorges in the uplands—like those of Spain—where a brown dryness spreads over the earth. In other parts we see smiling and fertile valleys, rolling, grassy highlands, topped by bare, rocky peaks.

It is said that there is not a spot of ground in this peninsula of Asia Minor that does not contain some relic of the stirring events which have swept over it for thirty centuries. For it has been not only the battlefield of powerful nations, but the home of the beautiful arts of peace and culture, which crossed to and from Greece by way of the lovely islands of the Archipelago.

THE GREAT SALT DESERTS OF PERSIA WHERE NOTHING WILL GROW

The highlands of this western peninsula stretch onwards and southwards to the beautiful forest-clad mountains of Lebanon in Syria, and eastwards to the high plateau of Armenia, connected with the Caucasus range. Skirting the base of the Caspian, the highlands spread over the greater part of Persia, sinking southwards into the Indian Ocean, and rising in the east to the highest mass of land in the whole world.

A rich tract of land lies round the south of the Caspian Sea, shut in by the Elburz range; and some other parts of Persia are very fertile too. But the greater part of the country consists of high and dreary plateaus and deserts; in the east these tracts are full of salt, where nothing will grow.

Mesopotamia, the land of the two great rivers, separates the highlands of Persia, or Iran, as its inhabitants call it, from those of the immense southern

peninsula of Arabia. To-day, Mesopotamia is chiefly a dry and dreary country, with very few people living in it, and its fields beyond the river-banks are little cultivated. In Abraham's time, and earlier and later too, there were thousands of people living in great cities, whose buried ruins now dot the desolate landscape; others worked in the rich green fields and orchards and farms, watered by a wonderful system of canals and ditches and other channels.

Arabia is said to be a million square miles in extent—ten times the size of New York, New Jersey, and Pennsylvania. It consists of a high tableland in the interior, with a fringe of fertile lowlands and valleys on parts of the coast, especially to the south. Rocky plains, stony peaks, and naked cliffs are found all over this tableland, as well as wide stretches of grass where flocks and herds find pasturage; and here and there are cultivated patches of land, where water can be obtained.

In the deserts of the interior neither vegetation nor animal life can exist. The yellow sands reflect the glaring sunlight until the eyes ache and the senses reel. The heat is insupportable, and many a large caravan has been lost in the terrible sand-storms which rage from time to time.

It is only the outside rim of the country, and the mountain terraces above it, that can be called Arabia the

MAP SHOWING PERSIA AND THE OLD TURKISH EMPIRE IN ASIA, INCLUDING ARABIA

Blessed, or Happy. Here the cool sea-breezes temper the heat, and the thirsty soil has enough to drink. Coffee-gardens, date-groves, cinnamon-trees, and other spices all flourish on the edge of Arabia. An old writer even speaks of the sailors out at sea enjoying the odors of the sweet spices wafted to them from these luxuriant coasts.

CARAVANS OF PILGRIMS THAT CROSS THE DESERTS TO THE PROPHET'S SHRINE

We have spoken of the Christian pilgrims who visit the Syrian Holy Land. These are few and far between, compared with the numbers of Mohammedan pilgrims who visit their Holy Land of Arabia. Every good Mohammedan hopes to visit Mecca and Medina, the birth-place and burial-place of the Prophet, before he dies; and the desert routes are crossed by caravans of camels, from oasis to oasis, from Baghdad on the Tigris, from the Persian Gulf, from Damascus, bringing pilgrims from India, Persia, Central Asia, and far-spreading Turkey. Those from Egypt cross the Red Sea to Jiddah, the port of Mecca.

For centuries before the birth of Mohammed at Mecca, this town had been looked upon as a holy spot; and its temple—the kaaba, with its famous black stone—was a place of pilgrimage for tribes and peoples of varying beliefs who lived in Arabia and beyond. The wildest of these tribes wandered about the sun-baked interior, as they do to-day, seeking pasturage for their flocks and herds; the more civilized ones were partly settled in the fertile spots, tilling the ground and farming.

One of the first objects in the Prophet's life, after persuading his own family of his great mission, was to induce his countrymen to give up the idolatry that was carried on at the kaaba, and to worship only one God. Of this we read on page 3029.

HOW THE PROPHET OF ARABIA FLED FROM HOME TO SAVE HIS LIFE

He also tried to persuade them to sink differences and to unite as one nation. As is the case with all reformers, Mohammed had to face much opposition and great dangers. He had to flee from Mecca to Medina, on an oasis further north, to save his life. This is called the Hegira, or Flight, and it happened in 622. His followers all over the world date their years from the Hegira, as Christians date the calendar from the birth of Christ.

Mohammed died eleven years after the Hegira, without naming a successor, and he left no son. The first three caliphs, or successors, were: his father-in-law, Abu Bekr; his friend, Omar; and his son-in-law, Othman.

The fourth caliph was Ali, cousin and son-in-law of the Prophet. Many who held that Ali ought to have been the immediate successor of Mohammed looked upon the first three caliphs as usurpers. From early days Mohammedans split into two great sects on this difference; and bitter feelings were made worse by the death in battle of Hosain the son of Ali. His followers called his death a murder.

The teaching and the conquests that Mohammed began, spread with most amazing rapidity under these first caliphs. "During the reign of Omar," says an old writer, "the Arabs conquered 36,000 cities, towns, and castles, destroyed 4,000 Christian and other temples, and built 1,400 mosques.

THE FIERCE MOSLEM CONQUERORS WHO BROUGHT FIRE AND SWORD TO EUROPE

Nothing stopped the enthusiasm with which they sought battle and danger. Syria fell to their arms; and the provinces of Asia Minor were all won from the decaying Eastern Empire. The fire of conquest spread into Egypt, thence along the north coast of Africa, and across the Straits by the Pillars of Hercules into Spain and to France. Eastwards the blazing power of Mohammedanism spread across the country of the two great rivers into Persia.

We have read of the long wars between the Greek emperor and the Persians, and of the story of the piece of the true Cross, and of how Shireen, the Christian wife of the sun-worshipping Persian king, had to give it up. In the course of these wars the Persians gained from the Eastern emperor all the lands that had been won through the centuries by the Romans; and the Persian king, who had marched victoriously from the Euphrates to the Bosphorus, called himself the "Asylum of the Universe."

In the year that Mohammed made his famous flight from Mecca, the "Asylum of the Universe" stood on the Bosphorus, with just a mile of water between him and Constantinople. The heroism

SOME FAMOUS CITIES OF THE NEAR EAST

ISPAHAN, ONCE THE SPLENDID CAPITAL OF A POWERFUL PERSIA, IS NOW RAPIDLY DECAYING

*A DISTANT VIEW OF BAGHDAD, SHOWING THE BRIDGE OF BOATS OVER THE TIGRIS

A GATE IN TEHERAN, THE MODERN CAPITAL OF THE KINGDOM OF PERSIA

TOMBS IN THE DESERT, WHERE THE PERSIANS ARE FOND OF BURYING THEIR DEAD FOLK

That Persia is a decaying kingdom is well illustrated by Ispahan, which, at one time a world-famed and powerful city, is now being rapidly deserted. Whole streets and many palaces are tenantless. Teheran has never attained to the glory of ancient Ispahan. Baghdad is the city of eastern romance and fame.

and genius of the Emperor Heraclius turned the scale and saved the capital and empire; and Chosroes II. had to retire to his own country and be content with its limits and his grand palaces, adorned with the spoils of the treasure-houses of many nations.

Suddenly, in a most tragic way, the splendor of the Persian kingdom came to a miserable end; for only a few years after the torch had been lighted by the Prophet, his successors, burning with zeal, turned their arms against Persia, and shattered the hosts arrayed against them, despite the desperate valor of the Persians and the heavy charges of the lines of elephants.

The Mohammedans crushed the old fire-worship of the Persians. Some few of the old faith remained steadfast in their own country; and many fled to India, where their descendants to this day are known as Parsees, or Persians. Thus, Persia—that most ancient kingdom—passed under Arab rule, though often, during the eight centuries that followed, the governors of different provinces were practically independent.

The splendor of the caliphs and the great learning of their people

The caliphs who ruled over South-western Asia shifted their capitals from time to time, and we catch glimpses of the splendor of their courts at Damascus, in Syria, and Baghdad, on the Tigris. It is at the latter place that we meet the Caliph Harun al Rashid, surnamed the Just, the Upright, the Great. He made a treaty with Charlemagne, and was the hero of many of the stories of the Arabian Nights. He twice crossed the mountains of Asia Minor and defeated the Greek emperor Nicephorous. He was a great patron of the arts and of the learning for which the Arabs became so famous. It is to them we owe the figures we use in place of the more cumbersome Roman numerals. It is said they first found out how to use the compass, and introduced the use of paper, which they learned how to make from the Chinese. Their researches in mathematics and astronomy paved the way for all future study; and the traces of their wonderful architecture and skill in decoration are still a delight, wherever we find them, from Persia to Spain.

About the time when the Normans were intent on conquering England, a race called the Seljouk Turks made their way from the East. They early became Mohammedans and overthrew various states in Persia, conquered Armenia and Georgia, and overran Asia Minor and the surrounding territories.

How the caliph of Baghdad gave his power to the Turkish leader

It was in 1055 that a dramatic scene took place in Baghdad, when the Caliph Kaim, to escape further troubles, put himself under the protection of the leader of the Seljouk Turks, and gave up to him the temporal power of the caliphs. The Seljouk kissed the dust before the caliph, then ascended the throne and received the two crowns of Persia and Arabia. Many mosques and colleges rose up in Baghdad, new roads and canals were made, and the boundaries were extended in all directions.

It was the action of these Seljouk Turks on the Christian pilgrim routes through Asia Minor and in the great centre of Jerusalem that inflamed Western Europe to start on the famous Crusades. Arabs and Turks united against the Christians, and much terrible fanaticism was aroused. The hero of the Mohammedans in these long wars was Saladin, famous for his courage, his justice, and his fidelity to his plighted word. On the Christian side there rise before us the forms of Godfrey of Bouillon, the lion-hearted Richard; the German Frederick Barbarossa, who was drowned off Asia Minor; the Prince of Wales, afterwards Edward I., and Louis XI., St. Louis of France.

Barely two centuries after the rise of the Seljouk Turks a fresh wave of conquerors swept from the unknown East over Persia and the rest of South-western Asia. These were the Mongols, under their leader, Jenghis Khan. Province after province fell before them. Baghdad was captured and destroyed, and the valuable library of the caliphs burned.

The coming of the Tartars and the fury of their conquest

Western Asia became more and more desolate under the fierce and bitter struggles of the various parties seeking power; and in 1387 a fresh horde of Mongolian Tartars poured over the whole country in a perfect storm of conquest, under Timur, or Tamerlane.

A new race of Turks called Osmanli, or Ottomans, after their first independent

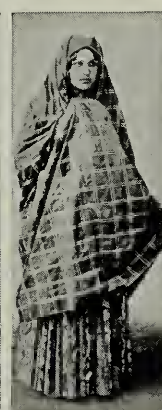
THE PEOPLE OF PERSIA AND ARABIA

An infuriated crowd of Persians rushing through the streets of Tabriz clamoring for a parliament and a constitution. This was granted by the Shah, but was afterwards withdrawn, an action that led to civil war.

A wealthy Persian merchant of today.

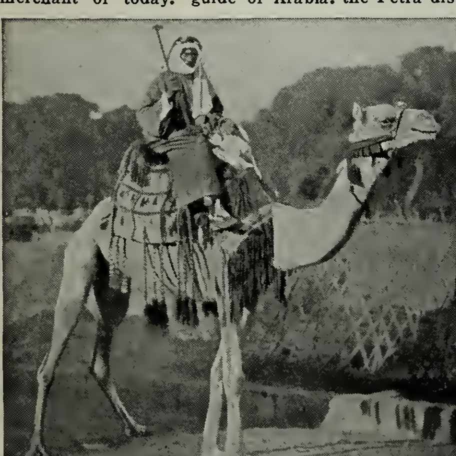
Armed caravan guide of Arabia.

A group of Bedouins from the Petra district in Arabia.



A poor peasant woman of Persia.

A wealthy Persian lady of high rank.



The Bedouin of the Arabian desert is generally seen riding on his dromedary or resting in his portable tent.

The Arab carries everything belonging to him upon his camel—his wife and family, his clothes and house.

leader, Osman, or Othman, had arisen in Asia Minor about fifty years before Timur's appearance, and had conquered most of the provinces in Asia Minor and also threatened the destruction of the European possessions of the Eastern Empire, as we read in the story of the Balkan Peninsula on page 3190.

THE FALL OF CONSTANTINOPLE AND THE MAKING OF MODERN TURKEY

But the conquests and fury of the Mongols delayed the taking of Constantinople and the final fall of the long-dying Eastern Empire yet another fifty years, during which time the state of Asia Minor, of Syria, of Mesopotamia and of Persia was very grievous.

By degrees the Ottoman power rose again. Constantinople fell in 1453; and the various provinces long known as Turkey in Asia were gradually gathered into the grasp of the Turkish despots. We have seen what their rule was in Europe. It brought much the same deadlock of despair in Asia. Towns, once flourishing, lost their trade, and the fairest plains were left without cultivation; canals became choked; roads were neglected; the inhabitants, ground down with taxation and unjust misgovernment, became apathetic and idle about work; and hostilities between different tribes and peoples were ever breaking out, to the misery and loss of all.

The Armenians, who clung with firmness to the Christian faith, for centuries have suffered cruel persecutions, plunderings, and attempts at extermination. In Syria, neither the mountain tribes of Lebanon nor the Arabs of the steppes have been willing to accept the Turkish yoke; and many have been the struggles, and rebellions, and bitter revenges that have taken place.

HOW THE LAND OF THE MOSLEM CONQUERORS SANK BACK INTO OBSCURITY

Turkish pashas, or governors, have been quite incapable of dealing with the difficulties of restoring Mesopotamia to prosperity; and Arabia, left to itself, sank into the insignificance of small independent states, which were for the most part hostile to each other. In the desert interior, the old Arab tribes and clans, headed by their sheikhs, have roamed on as their ancestors did of old, moving their tents of goats' hair at will, quarreling about pastures and wells, and living a simple, pastoral life. In 1916 many of them rebelled against the Turkish power, and became independent. It will be many years before the fate of much of the land in Western Asia is decided.

In Persia the long centuries of crushing dependence came to an end when the Mongol rule gave way to a national government under Ismail, at the opening of the sixteenth century. He took the old Persian title of shah. It was not long before progress was made in enlarging the borders of the kingdom towards Georgia and Mesopotamia.

Queen Elizabeth sent envoys from England, hoping to open up trade and gain a footing in the East. The greatest of the Persian shahs, Shah Abbas, ruled in those days, and he not only extended his dominions, but did much to promote prosperity within them. He made roads and bridges, rebuilt the beautiful city of Ispahan, encouraged the silk industry for which Persia had been famous in the past, and furthered trade with Russia. Persian troops, in conjunction with an English fleet in the Persian Gulf. drove the Portuguese from their settlement at Ormuz. Pearl fisheries are still carried on in the Persian Gulf.

THE FALL OF PERSIA FROM ITS GREAT POWER TO ITS PRESENT WEAKNESS

Before long, new enemies threatened Persia. The Afghans, a practically independent people on the Indian frontier, boldly laid siege to Ispahan, and entered in triumph. For many years there were bitter quarrels about the form of Mohammedanism that should be followed and about the succession to the throne. At the end of the eighteenth century the capital was transferred to Teheran; and the kingdom, little by little, lost its western provinces. Russia crept over the Caucasus and annexed part of Armenia; the land east of the Caspian also fell under the influence of Russia.

We have, perhaps, a general idea of the strong contrasts of Persia; of the wide-spreading deserts, crossed by caravans, carrying silks and carpets, dates, and embroideries to the ports on the Caspian and Black Seas; of the fertile patches, or oases; of the far-scattered towns. We now want to see everything closer, to meet the people, and understand, as far as we can, how absolutely different Persia is from anything we know in the West. Railways

not being available, for there are at present only two short lines, let us join in imagination an adventurous motor-car party, determined to penetrate to Ispahan, in the very heart of Persia. It needs some courage, for the roads are generally bad, and accommodation and food are very poor.

We must pass over the pleasures of running round the south of Russia, the tossing on the Black Sea, the run by train from Batum to Baku, the smell of the oil in the puddles, the difficulties on the Caspian, especially in landing the car on Persian soil. Round the south of the Caspian, the Garden of Persia, we pass through a paradise of green vegetation of every kind, from rice-fields, shimmering in water, to stretches of daisies, lilies, irises, so high that one can easily be lost in them; and everywhere are lovely lilacs and other flowering trees, in which the nightingales sing. But this is only one aspect of Persia, as we soon discover when we push on through the mountain barrier that guards the great plateau of Iran; and we shall be lucky indeed if the car does not break down with bounding from rock to rock or sinking into the stiff mud of the almost neglected roads.

A LAND OF CAMEL CARAVANS, WHERE THERE ARE NO HOTELS

If it does break down, the only alternative is to hire a native carriage, without springs, and change horses at the post-houses; and a long and wearisome journey it is, for hotels and inns, as we understand them, are unknown. Day after day we plod along over the stony desert, occasionally relieved by dark forests and spots of cultivation. In the distance we see dry and grim-looking mountains. And the sun pours down in intense heat, so that the caravans with the camels which we meet only travel by night.

It is a relief to see the white-pointed peak of Demavend, and at last to enter Teheran. Under its sky of fixed blue, the roses flower for which Persia is so famous—hedges and gardens with great masses of them—and the fresh, dry air makes us ready to enjoy everything. The palaces and gardens are very fine, also the beautiful lustre pots, and beautiful old stuffs, brocades, and carpets that we are invited to buy. And the crowds that pass! These are so different from any we have seen before. Besides the interesting camels and grey donkeys, there are women with long, thick white veils and full black cloaks covering them up completely; and men of different nationalities—Hindoos, Turks, Mongols—besides the Persians in their high black hats and brown flowing robes. The descendants of the Prophet are everywhere, in their turbans of blue or green; and the mullahs, or priests, are conspicuous in their white headgear among the crowd.

A GARDEN CITY IN THE MIDST OF A DREARY DESERT

But our object is to push on to Ispahan, over many more miles of burning desert, with the sand too hot to touch, though at night the air is crisp and dry, and the deep sky is simply blazing with stars. Every now and then there is the joy of an oasis, with its limpid streams and little village surrounded by fields of corn and rye and cheering wild flowers. When these are passed, there is again the smarting heat, the burned-out-looking mountains, with their sheer walls of every shade of dull red and dark purple, and not a tree or blade of grass to lighten the desolation.

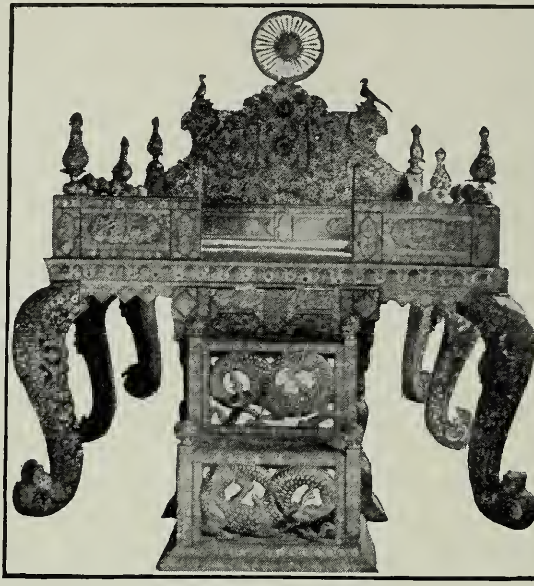
At last we see the domes of the mosques of Ispahan between the trees, and turning from the bare mountains in the distance, which now look as if bathed in gold, we do not know what to enjoy most. The avenues of trees, the fields of roses and white poppies, the gardens, the pale green streams and canals, the buildings of the great Shah Abbas, which date from the end of the sixteenth century—everything is wonderful and interesting. The enameled tiles and plaques, the blue cupolas and minarets of the mosque, the fine square, all fill us with admiration; and there are also the immense bazaars, where we can buy everything under the sun, and where potters, and weavers of cashmeres and carpets, and leather-workers are all following their interesting and useful trades.

HOW THE CHILDREN LEARN IN THE SCHOOLS OF PERSIA

In most of the schools in Persia only little boys are taught to read the Koran, which they chant as they swing to and fro in imitation of the prophet on his camel, as he fled to Mecca. But gradually a desire for education has grown, and there are now a number of very good schools for girls, as well as for boys, where many things are taught.

Persia is one of the countries which has recently gained a constitution. One was granted to them in 1906, signed by the Shah and his son, but it was of very little use to the bulk of the people; and fresh attempts on the part of the people to win freedom drove the old Shah from his throne and put a boy in his stead.

The Russians and the British, whose possessions touch Persia on the north and east, have agreed that its independence shall be respected. But the country is deeply in debt; it was drawn into the Great War, and it is feared that it may be many years before it can become even moderately prosperous. An election was held in 1914, the year in which the young Shah was crowned, and an attempt is being made to govern the country with the aid of the Cabinet and National Council, as the Assembly is called in Persia.



THE PEACOCK THRONE OF THE SHAHS OF PERSIA

The people of all these countries of Western Asia belong to a number of different races. They have been utterly crushed by many centuries of despotic rule. They do not know what it is to govern themselves, and the reformers who would teach them the responsibilities as well as the blessings of self-government have a most difficult task before them, and one that will take many years to accomplish, but will free Western Asia.

PERSIAN REBELS DISCUSSING PEACE TERMS WITH THE REPRESENTATIVES OF THE SHAH

During the civil war in Persia for a constitution and a parliament, the British consul at Tabriz arranged a meeting between the rebel leaders and the representatives of the Shah. Here we see the delegates seated upon a rich Turkish carpet with no other furniture, smoking their hookahs, or Eastern pipes.

THE NEXT STORY OF COUNTRIES IS ON PAGE 3923.

A SELECTION FROM HIAWATHA

THE scene of this poem is laid among the Ojibways, an Indian tribe on the southern shore of Lake Superior, in the region between the Pictured Rocks and the Grand Sable. The song is founded on a tradition that Hiawatha, a great warrior and teacher of mysterious origin, was sent to instruct the Indians in the arts of peace. He invented the birch bark canoe, and taught the people how to clear their watercourses and fishing grounds. When rumors of war arose he went with his daughter to attend a council of braves. As he stepped from his canoe, a huge white bird dropped upon his daughter, and crushed her to earth, and when the bird's body was lifted no trace of the girl could be found. Hiawatha silently bore his grief, but later called together the Five Tribes and gave them a plan of union. Then he bade them all a solemn farewell. Around this legend, Longfellow has woven many tribal myths. Hiawatha, the Wise Man, was the son of Mudjekeewis, the West Wind, and Wenonah, the daughter of Nokomis.

THE SONG OF HIAWATHA

HIAWATHA'S CHILDHOOD

CONTINUED FROM 3795

BY the shores of Gitche Gumee,
By the shining Big-Sea-Water,
Stood the wigwam of Nokomis,
Daughter of the Moon, Nokomis.
Dark behind it rose the forest,
Rose the black and gloomy pine-trees,
Rose the firs with cones upon them;
Bright before it beat the water,
Beat the clear and sunny water,
Beat the shining Big-Sea-Water.
There the wrinkled, old Nokomis
Nursed the little Hiawatha,
Rocked him in his linden cradle,
Bedded soft in moss and rushes,
Safely bound with reindeer sinews;
Stilled his fretful wail by saying,
"Hush! the Naked Bear will get thee!"
Lulled him into slumber, singing,
"Ewa-yea! my little owlet!
Who is this, that lights the wigwam?
With his great eyes lights the wigwam?
Ewa-yea! my little owlet!"

. . . .

At the door on summer evenings
Sat the little Hiawatha;
Heard the whisperings of the pine-trees,
Heard the lapping of the water,
Sounds of music, words of wonder;
"Minne-wawa!" said the pine-trees,
"Mudway-aushka!" said the water.
Saw the fire-fly, Wah-wah-taysee,
Flitting through the dusk of evening,
With the twinkle of its candle
Lighting up the brakes and bushes,
And he sang the song of children,
Sang the song Nokomis taught him:
"Wah-wah-taysee, little fire-fly,
Little, flitting, white-fire insect,
Little, dancing, white-fire creature,
Light me with your little candle,
Ere upon my bed I lay me,
Ere in sleep I close my eyelids!"
Saw the moon rise from the water
Rippling, rounding from the water,
Saw the flecks and shadows on it,
Whispered, "What is that, Nokomis?"
And the good Nokomis answered:
"Once a warrior, very angry,
Seized his grandmother, and threw her
Up into the sky at midnight;
Right against the moon he threw her;
'Tis her body that you see there."
Saw the rainbow in the heaven,
In the eastern sky, the rainbow,
Whispered, "What is that, Nokomis?"
And the good Nokomis answered:
"'Tis the heaven of flowers you see there;
All the wild-flowers of the forest,
All the lilies of the prairie,
When on earth they fade and perish,
Blossom in that heaven above us."
When he heard the owls at midnight,
Hooting, laughing in the forest,
"What is that?" he cried in terror,
"What is that?" he said, "Nokomis?"
And the good Nokomis answered:
"That is but the owl and owlet,
Talking in their native language,
Talking, scolding at each other."

. . . .

Then Iagoo, the great boaster,
He the marvelous story-teller,
He the traveler and the talker,
He the friend of old Nokomis,
Made a bow for Hiawatha;
From a branch of ash he made it,
From an oak-bough made the arrows,

Tipped with flint, and winged with feathers,
And the cord he made of deer-skin.
Then he said to Hiawatha:
"Go, my son, into the forest,
Where the red deer herd together,
Kill for us a famous roebuck,
Kill for us a deer with antlers!"
Forth into the forest straightway
All alone walked Hiawatha
Proudly, with his bow and arrows;
And the birds sang around him, o'er him,
"Do not shoot us, Hiawatha!"
Sang the robin the Opechee,
Sang the blue-bird, the Owaissa,
"Do not shoot us, Hiawatha!"
Up the oak-tree, close beside him,
Sprang the squirrel, Adjidaumo,
In and out among the branches,
Coughed and chattered from the oak-tree,
Laughed, and said between his laughing,
"Do not shoot me, Hiawatha!"
And the rabbit from his pathway
Leaped aside, and at a distance
Sat erect upon his haunches,
Half in fear and half in frolic,
Saying to the little hunter,
"Do not shoot me, Hiawatha!"
But he heeded not, nor heard them,
For his thoughts were with the red deer;
On their tracks his eyes were fastened,
Leading downward to the river,
To the ford across the river,
And as one in slumber walked he.
Hidden in the alder-bushes,
There he waited till the deer came,
Till he saw two antlers lifted,
Saw two eyes look from the thicket,
Saw two nostrils point to windward,
And a deer came down the pathway,
Flecked with leafy light and shadow.
And his heart within him fluttered,
Trembled like the leaves above him,
Like the birch-leaf palpitated,
As the deer came down the pathway.
Then, upon one knee uprising,
Hiawatha aimed an arrow;
Scarce a twig moved with his motion,
Scarce a leaf was stirred or rustled,
But the wary roebuck started,
Stamped with all his hoofs together,
Listened with one foot uplifted,
Leaped as if to meet the arrow;
Ah! the singing, fatal arrow,
Like a wasp it buzzed and stung him!
Dead he lay there in the forest,
By the ford across the river;
Beat his timid heart no longer,
But the heart of Hiawatha
Throbbed and shouted and exulted,
As he bore the red deer homeward,
And Iagoo and Nokomis
Hailed his coming with applauses.
From the red deer's hide Nokomis
Made a cloak for Hiawatha,
From the red deer's flesh Nokomis
Made a banquet in his honor.
All the village came and feasted,
All the guests praised Hiawatha,
Called him Strong-Heart, Soan-ge-taha!
Called him Loon-Heart, Mahn-go-taysee!

HIAWATHA'S DEPARTURE

Slowly o'er the simmering landscape
Fell the evening's dusk and coolness,
And the long and level sunbeams
Shot their spears into the forest,
Breaking through its shields of shadow,
Rushed into each secret ambush,
Searched each thicket, dingle, hollow;
Still the guests of Hiawatha
Slumbered in the silent wigwam.
From his place rose Hiawatha,
Bade farewell to old Nokomis,
Spake in whispers, spake in this wise,
Did not wake the guests, that slumbered:
"I am going, O Nokomis,
On a long and distant journey,
To the portals of the Sunset,
To the regions of the home-wind,
Of the Northwest wind, Keewaydin.
But these guests I leave behind me,
In your watch and ward I leave them;
See that never harm comes near them,
See that never fear molests them,
Never danger nor suspicion,
Never want of food or shelter,
In the lodge of Hiawatha!"
Forth into the village went he,
Bade farewell to all the warriors,
Bade farewell to all the young men,
Spake persuading, spake in this wise:
"I am going, O my people,
On a long and distant journey;
Many moons and many winters
Will have come, and will have vanished,
Ere I come again to see you.
But my guests I leave behind me;
Listen to their words of wisdom,
Listen to the truth they tell you,
For the Master of Life has sent them
From the land of light and morning!"
On the shore stood Hiawatha
Turned and waved his hand at parting;
On the clear and luminous water
Launched his birch canoe for sailing,
From the pebbles of the margin
Shoved it forth into the water;
Whispered to it, "Westward! Westward!"
And with speed it darted forward.
And the evening sun descending
Set the clouds on fire with redness,
Burned the broad sky, like a prairie,
Left upon the level water
One long track and trail of splendor
Down whose stream, as down a river,
Westward, westward Hiawatha
Sailed into the fiery sunset,
Sailed into the purple vapors,
Sailed into the dusk of evening.
And the people from the margin
Watched him floating, rising, sinking
Till the birch canoe seemed lifted
High into that sea of splendor,
Till it sank into the vapors
Like the new moon slowly, slowly
Sinking in the purple distance

SHUFFLE-SHOON AND AMBER-LOCKS

BY

EUGENE FIELD

Shuffle-Shoon and Amber-Locks
Sit together, building blocks;
Shuffle-Shoon is old and grey,
Amber-Locks a little child;
But together at their play
Age and youth are reconciled,
And with sympathetic glee
Build their castles fair to see.

"When I grow to be a man,"
So the wee one's prattle ran,
"I shall build a castle so—
With a gateway broad and grand;
Here a pretty vine shall grow,
There a soldier guard shall stand;
And the tower shall be so high,
Folks will wonder, by-and-by!"

Shuffle-Shoon quoth: "Yes, I know;
Thus I builded long ago!
Here a gate, and there a wall,
Here a window, there a door;
Here a steeple wondrous tall
Riseth ever more and more!
But the years have levelled low
What I builded long ago!"

So they gossip at their play,
Heedless of the fleeting day.
One speaks of the Long Ago
Where his dead hopes buried lie;
One with chubby cheeks aglow
Prattleth of the By-and-by;
Side by side they build their blocks—
Shuffle-Shoon and Amber-Locks.

From 'Love Songs of Childhood" copyright, 1894, by Eugene Field, published by Charles Scribner's Sons.

DOCTOR FAUSTUS was a good man,
He whipped his scholars now and then.
When he whipped them he made them dance,
Out of Scotland into France.
Out of France into Spain,
And then he whipped them back again!

JOHN COOK had a little grey mare; he, haw, hum!
Her back stood up, and her bones they were bare; he, haw, hum!

John Cook was riding up Shunter's bank; he, haw, hum!
And there his nag did kick and prank; he, haw, hum!

John Cook was riding up Shunter's Hill; he, haw, hum!
His mare fell down, and she made her will, he, haw, hum!

The bridle and saddle were laid on the shelf; he, haw, hum!
If you want any more you may sing it yourself; he, haw, hum!

I DO not like thee, Doctor Fell;
The reason why I cannot tell.
But this I know, and know full well,
I do not like thee, Doctor Fell.

"WE are three brethren out of Spain,
Come to court your daughter Jane."
"My daughter Jane she is too young;
She has no skill in a flattering tongue."

"Be she young, or be she old,
It's for her gold she must be sold;
So fare you well, my lady gay,
We'll call again another day."

"Turn back, turn back, thou scornful knight,
And rub thy spurs till they be bright."
"Of my spurs take you no thought,
For in this land they were not bought.
So fare you well, my lady gay,
We'll call again another day."

"Turn back, turn back, thou scornful knight,
And take the fairest in your sight."
"The fairest maid that I can see
Is pretty Nancy. Come to me!"

IF you are to be a gentleman, as I suppose you be,
You'll neither laugh nor smile for a tickling of the knee.

BUTTONS, a farthing a pair,
Come, who will buy them of me?
They're round and sound and pretty,
And fit for the girls of the city.
Come, who will buy them of me,
Buttons, a farthing a pair?

MASTER I have, and I am his man,
Gallop a dreary dun;
Master I have, and I am his man,
And I'll get a wife as fast as I can;
With a heighty gaily gamberally,
Higgledy, piggledy, niggledy, niggledy,
Gallop a dreary dun.

ROCK-A-BY, baby, thy cradle is green;
Father's a nobleman, mother's a queen;
And Betty's a lady, and wears a gold ring;
And Johnny's a drummer, and drums for the king.

TWO Robin Redbreasts built their nest
Within a hollow tree;
The hen sat quietly at home,
The cock sang merrily;
And all the little ones said:
"Wee, wee, wee, wee, wee, wee."

One day the sun was warm and bright,
And shining in the sky,
Cock Robin said: "My little dears,
'Tis time you learned to fly."
And all the little young ones said:
"I'll try, I'll try, I'll try."

I know a child, and who she is
I'll tell you by and by,
When Mamma says "Do this," or "that,"
She says "What for?" and "Why?"
She'd be a better child by far
If she would say "I'll try."

UPON St. Paul's steeple stands a tree,
As full of apples as may be;
The little boys of London Town,
They run with hooks and pull them down;
And then they run from hedge to hedge,
Until they come to London Bridge.

AROUND the green gravel the grass grows green,
And all the pretty maids are plain to be seen;
Wash them with milk, and clothe them with silk,
And write their names with a pen and ink.

CUSHY cow, bonny, let down thy milk,
And I will give thee a gown of silk;
A gown of silk and a silver tee,
If thou wilt let down thy milk to me.

THERE was a litte man,
And he had a little gun,
And his bullets were made of lead, lead lead;
He shot Johnny King
Through the middle of his wig,
And knocked it right off his head, head head.

THE PEN AND PENCIL OF KATE GREENAWAY

ALTHOUGH so many ladies have devoted themselves to the dainty art of illustrating and writing children's books, perhaps Kate Greenaway, who was born in 1846 and died in 1901, is the only one who became famous all the world over in this way. She was the daughter of a London wood-engraver, and studied art from her earliest years. There is such a charm and freshness about all her little drawings, and so quiet a touch of humor, that both old and young find them full of entertainment. Her simple verses are of less importance than her delightful illustrations, but they are tuneful and appropriate. A selection from her sketches and verses is given on these two pages and elsewhere by permission of the publishers, Messrs. Frederick Warne and Company.

LOOK over the wall, and I'll tell you why
The King and the Queen will soon pass by.
Madams and masters, look this way;
The King and his Court ride past to-day.

The Queen has a robe that is gold and red;
She is stately, and sits with a crown on her head;
And four very little boys after her go,
To do as she bids them—they never say "No."

The banners are waving, the soldiers are drumming;
'Tis indeed a fine sight that, I tell you, is coming!
So, if you look long enough over the wall,
You'll see a great deal, if you do not see all.

UNDER the window is my garden,
Where sweet, sweet flowers grow;
And in the pear-tree dwells a robin,
The dearest bird I know.

Tho' I peep out betimes in the morning,
Still the flowers are up the first,
Then I try and talk to the robin,
And perhaps he'd chat—if he durst.

PRINCE FINIKIN and his mamma
Sat sipping their bohea;
"Good gracious!" said his Highness, "why,
What girl is this I see?

"Most certainly it cannot be
A native of our town."
And he turned him round to his mamma,
Who set her teacup down.

But Dolly simply looked at them;
She did not speak a word.
"She has no voice," said Finikin;
"It's really quite absurd."

Then Finikin's mamma observed,
"Dear Prince, it seems to me,
She looks as if she'd like to drink
A cup of my bohea."

So Finikin poured out her tea,
And gave her currant-pie.
Then Finikin said: "Dear mamma,
What a kind Prince am I!"

THREE little girls were sitting on a rail,
Sitting on a rail,
Sitting on a rail;
Three little girls were sitting on a rail,
On a fine hot day in September.

What did they talk about that fine day,
That fine day,
That fine day?
What did they talk about that fine day,
That fine hot day in September?

The crows and the corn they talked about,
Talked about,
Talked about;
But nobody knows what was said by the crows,
On that fine hot day in September.

FIVE little sisters walking in a row;
Now, isn't that the best way for little girls to go?
Each had a round hat, each had a muff,
And each had a new pelisse of soft green stuff.

Five little marigolds standing in a row;
Now, isn't that the best way for marigolds to grow?
Each with a green stalk, and all the five had got
A bright yellow flower and a new red pot.

POLLY'S, Peg's and Poppety's
Mamma was kind and good;
She gave them each, one happy day,
A little scarf and hood.

A bonnet for each girl she bought,
To shield them from the sun;
They wore them in the snow and rain,
And thought it mighty fun.

But sometimes there were naughty boys,
Who called to them at play,
And made this rude remark: "My eye!
Three Grannies out to-day!"

LITTLE Miss Patty and Master Paul
Have found two snails on the garden wall.
"These snails," said Paul, "how slow they walk!
A great deal slower than we can talk.
Make haste, Mr. Snail, travel quicker, I pray;
In a race with our tongues you'd be beaten to-day."

THREE tabbies took out their cats to tea,
As well-behaved tabbies as well could be;
Each sat in the chair that each preferred,
They mewed for their milk, and they sipped and purred.
Now, tell me this, as these cats you've seen them—
How many lives had these cats between them?

THE WHITE HART

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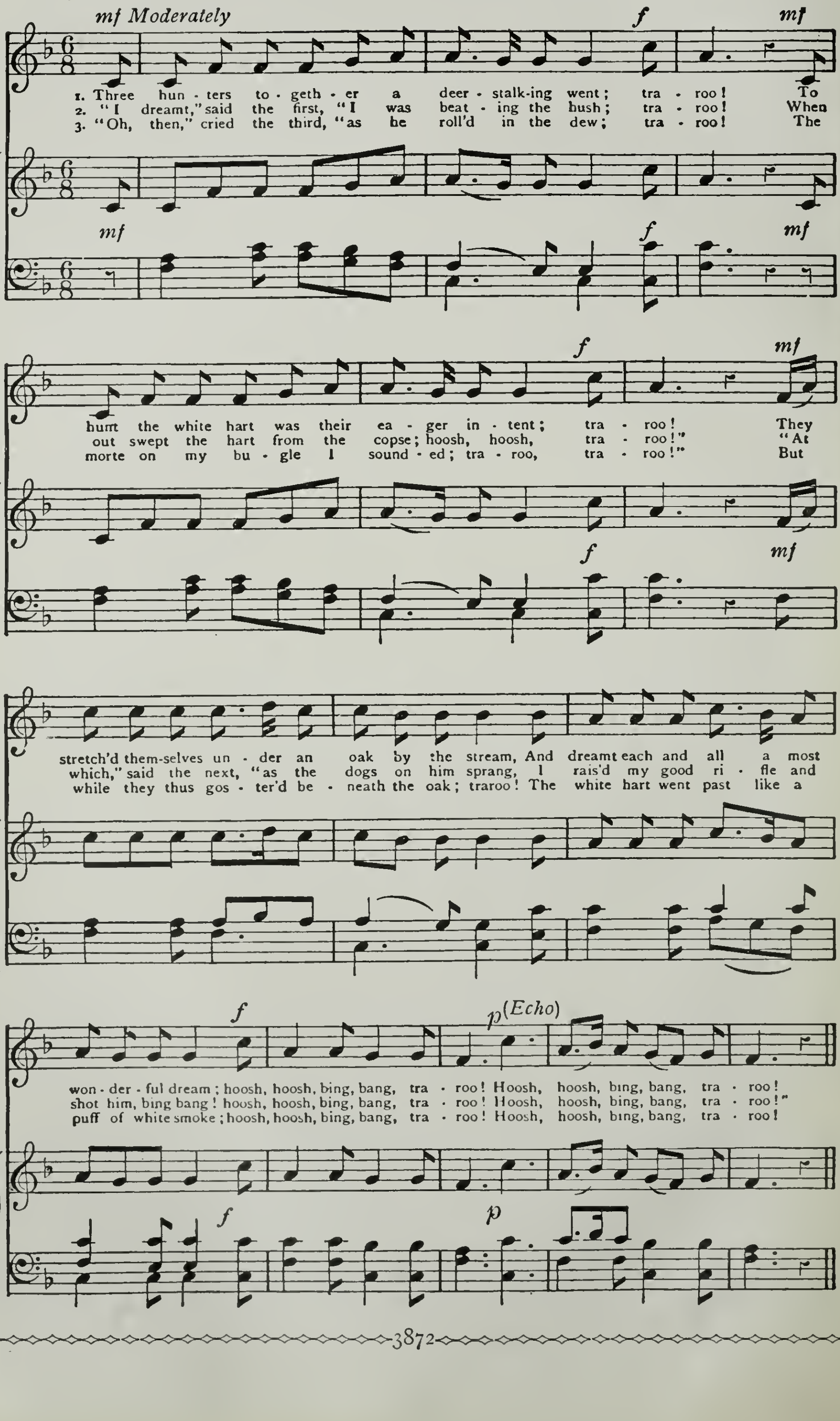


THE MILLER AND HIS PETS

CONTINUED FROM 3711

A LONG time ago a band of robbers settled in a hut on a lonely heath. They waylaid travelers and took their money, and broke into farmhouses and robbed the farmers. One afternoon, when the old miller who lived in the windmill on the edge of the heath had gone to town, the robbers entered his rooms, stole all his savings, and set fire to the mill.

The old miller returned in the evening and found that he was ruined. But what grieved him most of all was that the robbers had stolen all his provisions. He did not mind going without a meal himself, but there was no food for his donkey, his dog, his cat, and the two ducks. Being a lonely man, he had made great pets of all his animals. He loved them very dearly, and, rather than see them starve, he resolved to set them free. So he said to them:

"You see the robbers have taken everything. There is no hay for the donkey, no meat for the dog, no milk for the cat, no grain for the ducks. I can't keep you here, my pets, and let you die for want of food. Go out together, and see if you can't pick up something to eat on the heath."

All the animals were very sad at leaving their master, and they wandered about looking for food and lodging. At last they came to the hut where the robbers were sitting at a table eating their supper by the dim light of a tallow candle.

"Here's a chance to get a good shelter for the night," said the dog. "Crouch down in the bushes, all of you, and make as much noise as you can. See if we can't frighten these thieves out of their senses."

The animals hid themselves in the brushwood around the hut, and began to make a fearful racket.

"Hee-haw, hee-haw!" bellowed the donkey, with a voice like thunder.

"Mee-ow-u-ou!" shrieked the cat.

"Bow-wow-grr!" roared the dog.

"Qua, qua, qua!" squawked the ducks.

The robbers were greatly frightened by the strange uproar; and when one of the ducks flew in and knocked the candle over and left the hut in darkness, the men were terror-stricken, and they rushed out and fled wildly in all directions.

The animals then joyfully entered the hut, and made a good meal out of the robbers' supper, and then laid down to sleep. The donkey slept by the door, the dog underneath the table, the cat above it, and the two ducks on the top of the open door.

When the robbers recovered from their fright, their captain determined to see what had happened at the hut. He went back, and, finding the

place very dark and silent, he crept through the open door, but with the noise the animals at once awoke.

The dog sprang out and bit his leg. Then, as he passed the table, the cat jumped up and scratched his face. The two ducks spread out their wings and flapped about his head, and when at last he staggered to the door, the donkey gave him a terrific kick, and sent him flying into a prickly bramble bush. The robber captain crawled away, and told his men that a murderous gang had captured their hut and would kill them if they went back.

"One of them," he said, "stabbed me in the leg. Another just managed to graze my face with his knife. Three or four of them flapped a cloth about my head and tried to wrap it round me and stifle me. And just as I thought I had got safely away, someone struck me in the back with a great sledge-hammer, and very nearly killed me."

"We'd better leave this neighborhood at once," said his men.

They hurried away, more frightened than ever, and never did they return to the heath.

In the morning, the dog noticed that the ground had been disturbed in a corner of the hut. Scratching up the earth, he found a large sack full of money. This the donkey managed to hoist on his back, and the dog and the cat and the two ducks proudly marched by his side across the heath to the ruined mill. With the money that the animals brought to him, the old miller repaired and stocked his mill, and there he lived happily and quietly with all his pets, and often amused himself over the story of the capture of the robbers' treasure.

A SON OF A GUN

SCREWWORM sat down amongst the toadstools and opened the book which is called "Gnome Gnobodies." In America we have a book called "Who's Who." It tells us about famous people. In fairyland they have "Gnome Gnobodies," which is just the opposite.

In "Gnome Gnobodies" the gnomes read about gnomes who are not famous.

Screwworm opened his enchanting book at the letter T, and turned the pages till he came to the name Tompin. This is what he read:

"Tompin is a duffer and flighty. He was born on the planet Mars in the year 12, and emigrated to the earth in the year 1066. As he was neither woman nor man, he attached himself to the Normans, and followed them to England. His favorite recreation is stroking his chin. He neither reads nor writes. He earns his living by doing nothing. His favorite residence is the muzzle of naval guns, which he prefers to old-fashioned clubs. He can swim backward as well as forward. His present address is U. S. Dreadnought, At Sea."

When Screwworm had read this account of Tompin, he said: "That's the little fellow for my money. The very thing."

Something stirred at his side. He looked up and saw the Lizard.

"Good evening," said Screwworm.

"Certainly," answered the Lizard.

"How did you find Landsend?"

"Rocky," replied the Lizard.

"Now listen to me," said Screwworm, resting his arm on a toadstool and regarding the Lizard over his glasses. "Do you, or do you not, know Tompin?"

"I've seen him," answered the Lizard, "but I can't say that I know him. We don't speak. He's a son of a gun."

"Quite so. Now, I've invented a gun myself; it's a beauty. It fires sea-shells on the seashore. The shells are sells; that is to say, the sea-shells it sells are seashore sells. Not Wilkie's, for those are Bard—but Winkle's! Do you follow?"

"You mean to say, your gun fires winkle-shells which are sells; that is to say, they are not genuine. You are using slang?"

"You have me. I use slanguage for this reason—the mouth of my gun likes it. If you want to make a hit nowadays, you must use slang. I want to make a hit. Do you know what I want to hit?"

"Hush!" whispered the Lizard. "He's here!"

Screwworm turned his head. Tompin was regarding him over a toadstool.

"Good-evening, monsieur. Do you speak German?" asked Screwworm.

Tompin said nothing. His old face had a set smile, which was neither merry nor pleasant. You might have called it a blind smile, or even a dumb smile.

SOMETHING STIRRED AT SCREWWORM'S SIDE, AND, LOOKING UP, HE SAW THE LIZARD

"Don't you speak at all?" demanded Screwworm, frowning.

After waiting a long time for an answer, Screwworm got up, laid "Gnome Gnobodies" on the ground, and, walking over to Tompin, said: "Come hither, little bird!" Very gently he took the left ear of the old fellow between his finger and thumb and led him away.

"Monsieur," said he, "I have a gun."

Tompin stopped dead. His face quite lighted up.

"What's the matter?" asked Screwworm.

"I am saved," said Tompin — "if it's at all fatherly."

"Explain yourself."

"The Navy," said Tompin, "is practising gun-fire just now. There is not a single gun that is safe for me to sit in. The consequence is ——"

"Yes."

"I am an orphan, a waif, a homeless and fatherless wretch. It is immensely sad."

"You are welcome to sit in my gun. It shall adopt you."

"It won't go off—and leave me?"

"I shouldn't think so."

"Oh, thanks! For this relief, much thanks. Get you to a gunnery, as Shakespeare says. I'm your boy. Let us fly to it."

They continued their way. When they came to Screwworm's gun, the face of Tompin became very green.

"It smells fishy!" he said suspiciously.

"Try it," said Screwworm.

"I don't like the smell," muttered Tompin, poking his nose in the muzzle and sniffing deeply. "It suggests sea-shells. Too much mussel to be strong. I fear I might be oystered. If you will allow me, I will limpet."

He started to go on, but Screwworm caught him by the ear again, and said: "Try it, poor orphan."

"You are sure you don't mind?" asked Tompin.

"Tut!"

"Here goes, then!" cried Tompin; and he jumped into the muzzle of Screwworm's gun.

Quick as lightning Screwworm ran to the back of it, struck a match, and applied it to the touch-hole.

A bright flame shot into the air.

Something went *fiz-z-z-z-z!* And then there was a tremendous explosion.

The air for miles became black with winkle-shells.

Thousands and thousands of gnomes came rushing up from all directions. They found the gun lying on the ground, smoking hot, and emitting yellow and green flames. Screwworm and Tompin were nowhere to be seen.

Scramblepipe, who was among the company, exclaimed:

"Something has happened!"

At that moment the Lizard appeared in the midst of the group.

"My dear friends," said he, "if you will be patient for a few moments, you will see a sight worth seeing. Let me explain. This gun is so perfectly balanced that the pace of the discharge is equal to the pace of the recoil. The force is exactly equal to the circumference of the earth. Now, what has happened? Tompin from the muzzle of the gun and Screwworm from the breech of the gun are now at this moment going round the world. Do you follow me? If you wait a moment, you will see what I mean."

Scarcely had the Lizard ceased speaking, when Tompin from the east and Screwworm from the west appeared in the air, rushing towards each other at a pace so furious that all the gnomes instantly rushed for shelter under the toadstools.

"They passed each other half-way round the world," said the Lizard. "Now you will meet and embrace. Bang!"

At that minute the two bodies came together with a whack! Then they fell straight to the earth in each other's arms.

"Did you enjoy it?" asked Screwworm breathlessly.

"You have impressed me," said Tompin, with sincere admiration.

For a moment he regarded the gun, still smoking on the ground; then, with a rush of tears to his eyes, and quite overcome with emotion, he fell upon one knee, laid his arms lovingly about the gun, and, pressing his cheek against it, exclaimed:

"Papa, papa, I have come back to you!"

The Lizard turned to Screwworm, and said:

"Let us leave him where he is. The poor orphan is now at peace."

LITTLE STORIES ABOUT FLOWERS

Almost every flower has a story, just as almost every place has a legend, and many flowers have many stories. They are "made up," perhaps, as the legends are, but they are often very beautiful, and it is interesting to know the stories that have been told for hundreds of years about the flowers that bloom in our gardens still.

THE PANSY

THE charming name which many little English country maidens have given to the pansy is Three-Pretty-Faces-Under - One - Hood. The little French country maidens, however, called it Trinity Herb. At first, they say, the pansy had a sweeter and more delicious scent than its little sister, the March violet. It grew in the wheat fields, and it was much beloved because of its union of beautiful colors and exquisite fragrance, and everybody used to trample down the wheat to get it.

The result was, that when harvest-time came there was no food for the people. This grieved Three-Pretty-Faces-Under-One-Hood, and one spring-time, she prayed to the Trinity that she might be deprived of her sweet scent, so that nobody would destroy the growing wheat for her sake. Her prayer was granted, and her perfume taken away. From that time Three-Pretty-Faces-Under-One-Hood has been called Trinity Herb by the little French country maids.

THE FORGET-ME-NOT

IN the morning of the world, an angel was sent on an errand to a holy man dwelling in a desert in Persia. But as the angel was flying through the air he saw a beautiful Persian girl sitting by a well-side, and braiding her lovely hair with blue forget-me-nots. He came down and made love to her, and for a while they lived very happily together. Suddenly the angel remembered that he had not delivered his message. He flew back to heaven to ask pardon, but he found that the gate of heaven was closed to him. For a long time he stood by the closed gate weeping, and then the Archangel Gabriel appeared, and said:

"It is ordered that you must people the earth with the Children of the Sky before you can bring a daughter of the earth into heaven."

The angel did not understand what this meant, and asked his beautiful bride if she could explain it.

"Yes," she replied, taking some of the flowers from her hair. "These lovely blue forget-me-nots, which reflect the exquisite color of heaven, are the Children of the Sky."

So the angel and his bride wandered hand in hand over the earth, and planted forget-me-nots in every country. Then, when their task was ended, the angel took his bride in his arms, and carried her up to the gate of heaven.

THE ROSE

IN the days of the ancient gods, there lived in the Greek town of Corinth a lady whose name was Rhodanthe. Rhodanthe was ravishly beautiful, and her house was besieged by kings and lords, who were eager to win her love.

In order to escape from the throng of her lovers, Rhodanthe fled for refuge into the temple of the white and lovely goddess of purity, Artemis. But her lovers followed her, and the people of Corinth helped them to break open the gates of the sacred temple. Artemis was angered by the outrage, and she changed Rhodanthe into the red rose, which is still deeply colored with the blush which spread on Rhodanthe's cheeks when her beautiful face was exposed to the gaze of her lovers. The breakers of the temple, on the other hand, were changed into the thorns which now guard the loveliness of Rhodanthe.

THE ANEMONE

THERE was once a Spirit of the Flowers whose name was Chloris, and the Spirit of the West Wind used to come into her garden and make love to her. The Spirit of the Flowers had many pretty nymphs in her garden, and among them was a little maiden who was called Anemone.

One day the Spirit of the West Wind turned away from Chloris and began to make love to Anemone. This made Chloris very angry, and she drove Anemone out of her garden, and left her to perish in the wild woods.

Happily, the Spirit of the West Wind passed through the woods, and he found Anemone, just as she was dying, and turned her into the little, white, tender, and graceful flower which now grows beneath the trees in early spring.

FABLES OF ÆSOP THE SLAVE

THE JACKDAW AND THE PIGEONS

A JACKDAW who noticed that the pigeons in a certain dovecot were very well fed, whitewashed his feathers

in order to look as much like a dove as possible, and went and lived among them. The pigeons, so long as he kept silent, did not recognize him; but at last he forgot that he was acting the part of a dove, and began to chatter like a jackdaw.

Then the pigeons saw what he was, and drove him away. But when he flew back to the church tower, the other jackdaws, not knowing him in his discolored feathers, also drove him away, so that he had no home to go to.

It is no use pretending to be what we are not, for we are sure to be found out sooner or later.

THE THIEF AND THE DOG

A THIEF came to rob a certain house one night, but was disturbed by a fierce dog, which kept continually barking at him.

The thief, thinking to stop his mouth, threw him a piece of meat. The dog

refused it with indignation, telling him that before he only suspected him to be a bad man, but now that he had tried to bribe him he was certain of it. He added that the care of his master's house was entrusted to him, and he should never stop barking while such a man was about.

When anyone offers us a present not to tell, we may be sure that there is something wrong.

THE FOX AND THE BOAR

A BOAR was one day sharpening his tusks against the trunk of a tree. A fox who happened to be passing at the same time asked why he was making

these warlike preparations when there was no enemy near.

The boar answered: "That is quite true, Mr. Fox; but we should always sharpen our weapons while we have leisure, for in time of danger we shall have something else to do."

Never be idle. We can always find something to do.

THE GOOSE WITH THE GOLDEN EGGS

A MAN once had a goose which laid a golden egg every day; but he was so greedy that he was not content with this, and so he killed the goose and cut her open, thinking that he would find

enormous riches inside her. But, to his great disappointment, he found nothing; and after the goose was killed, of course, no more golden eggs were laid.

We gain nothing by being greedy.

THE ANGLER AND THE LITTLE FISH

A MAN was angling in a river and caught a very small perch. As he was taking out the hook, and going to put the fish into his basket, it opened its mouth and began to beg for pity, and to ask that he would throw it into the river again.

The man asked why he should do so. The fish answered:

"Because at present I am so very young and small and not worth much; but if you throw me back into the river you may be able to catch me at some

future time when I have grown much larger." But the man answered that he was not so silly as to throw away a little fish when he was not at all sure of catching him when he had got big.

A bird in the hand is worth two in the bush.

THE ASS IN THE LION'S SKIN

A DONKEY chanced one day to find the skin of a lion, and put it on. Then he went into the woods and fields and frightened all the flocks and herds. At last the donkey met his owner and tried to frighten him, too; but the man, noticing the long ears of the donkey, at

once recognized what animal he really was, and gave him a sound beating with a thick stick.

It is of no use to pretend to be greater or cleverer than we are.

THE WIND AND THE SUN

ONE day the north wind and the sun were having an argument as to which was the stronger, and they agreed to try their strength upon a traveler. The one that got the traveler's cloak off

first was to be the winner. The north wind began, and blew a strong, cold blast, accompanied by a sharp, driving shower of rain. But instead of blowing the man's cloak off, it only made him hold it round his body all the more closely.

The sun's turn came next, and he began to shine as hot as possible upon the head of the poor weather-beaten traveler. The man grew faint with the heat and unable to bear it any longer, so he threw off his heavy cloak and took shelter in a neighboring wood. Thus the sun was the winner.

Gentle persuasion often succeeds where force fails.

THE WOMAN AND THE EMPTY CASK

AN old woman saw an empty cask lying on the ground from which the wine had just been emptied. She put her nose to the bung-hole and sniffed for some time at the cask, which still smelt pleasantly of the wine. Then she

exclaimed: "Oh, what a delicious smell! How good the contents must have been when even the cask smells so nice!"

Good actions, like sweet wine, leave pleasant memories behind them.

AMY ROBSART

SORE and sad that lady grieved
In Cumnor Hall, so lone, so drear;
Full many a piercing scream was heard,
And many a cry of morbid fear.
The death-bell thrice was heard to ring,
An aerial voice was heard to call;
And thrice the raven flapped its wing
Around the tower of Cumnor Hall.

And in that manor now no more
Is cheerful feast and sprightly ball;
For ever since that dreary hour
Have spirits haunted Cumnor Hall.
The village maids, with fearful glance,
Avoid the ancient moss-grown wall;
Nor ever lead the sprightly dance
Among the grass of Cumnor Hall.

WHO was this lady who grieved in Cummor Hall, and for whom "the death-bell thrice was heard to ring"? She was the daughter of an English gentleman who owned great estates in Cornwall, a certain Sir John Robsart, a man of ancient family and great wealth. She was the heiress of this rich landowner, and rumor says that she was very beautiful.

We can imagine how happy was the childhood of little Amy Robsart in her Cornish home. With a father who adored her, peasants who smiled to see the little lady pass, and a beautiful home, life must have seemed to her a gift expressly made for her enjoyment. And later her happiness must have been greater still. For there came to visit her, and to make love to her, one of the most striking men who ever walked the earth. This was a certain Lord Robert Dudley, a youth so handsome and so gracious in manner that he was reckoned the Apollo of that age. He was tall, strongly but gracefully formed, with a countenance that might have been chiseled, so fine were the features, so delicate the lines. He had the soul of a poet for lovely scenery, and the soul of an artist for splendid buildings.

AMY ROBSART WAS THROWN DOWNSTAIRS

This youth had been sent to Cornwall by his father, an ambitious man, who had arranged with Sir John Robsart that his handsome son should marry the daughter of the rich knight.

After a delightful courtship, and while they were still little more than children, on June 4, 1550, at the palace of Sheen, with King Edward VI. present at the brilliant ceremony, Amy Robsart was married to Lord Robert Dudley.

For ten years they lived together, happily at first, but soon with a gradually increasing unrest. Amy began to see that her handsome boy husband was consumed by one overmastering passion—the passion of ambition. He could not be happy with home life. He wanted to be a figure at court—to outshine all others. He wanted to be a power in the state.

After Edward died, and Elizabeth became Queen of England in 1559, Lord Robert Dudley was soon known to be her favorite, and it was rumored that she would marry him if he were free. She continually showered royal favors upon him. He became Knight of the Garter, Baron of Denbigh, and later the Earl of Leicester. He became the chief jewel of her gorgeous court, and nothing seemed beyond the aspirations of the handsome young courtier. And what became of Amy? She was sent by her husband to Cumnor Hall, near Oxford. This was the residence of a gentleman

named Anthony Foster, who was fond of music and gardening, and said to be a worthy and sagacious man. He was something more. He was in the pay of Lord Robert Dudley.

One night, when a man named Sir Richard Varney, also in the pay of Lord Robert Dudley, was alone with his servant in Cumnor Hall, the chamber door of Amy Robsart was burst open; she was strangled, knocked about the head, and thrown down a flight of stairs. The next day the story was told that Lord Dudley's wife had fallen down a flight of steps, and broken her neck.

Such is the sad story of poor Amy Robsart, the heroine of Sir Walter Scott's romance "Kenilworth." But it is doubted by some learned men whether Lord Leicester, as her husband became, was really guilty of her murder. The proofs are not clear The history is very obscure. Lord Burleigh certainly declared against Queen Elizabeth's marriage to Lord Leicester, when she thought of making him her husband, because that nobleman was "infamed by the death of his wife." The death of Amy Robsart was, of course, a considerable scandal at that time; and many people thought that her ambitious husband was glad to get rid of her.

But Lord Robert Dudley may have been innocent. His friends and dependants, hoping to advance themselves by his increasing glory, may themselves have contrived the diabolical act. "With his wife out of the way," they may have argued, "he will marry the queen, and we shall all be great men." The murder of Amy Robsart, so far as her husband is concerned, remains one of the mysteries that will probably never be solved.

LES OIES QUI GARDAIENT ROME

THE ENGLISH VERSION OF THIS STORY IS GIVEN ON PAGE 576.

ROME était assiégee. Un terrible et nouvel ennemi l'attaquait. Ces hommes venaient du Nord. Ils étaient grands et sauvages, avaient des yeux bleus perçants et de longs cheveux d'or qui brillaient. Ils s'appelaient les Gaulois.

Des batailles sanglantes furent livrées dans la ville et les légions romaines se virent repoussées sans cesse. Les Gaulois étaient non seulement forts, mais audacieux. Ils se jetaient sur les Romains en poussant des cris terribles et déchiraient leurs rangs.

Les pauvres Romains furent finalement obligés de se retirer dans leur dernière forteresse, appelée le Capitole. Ils s'y trouvaient en sûreté, car qui aurait jamais songé à escalader le roc à pic pour franchir les murs puissants du Capitole? Mais c'était terrible et triste pour les soldats romains, bien qu'ils fûssent en sûreté, de voir du haut des murs du fort, les sauvages Gaulois brûlant leurs maisons et s'emparant de tout ce qu'ils possédaient de précieux comme butin.

Les Romains bientôt eurent affreusement faim. Plus d'une fois, ils durent regarder les oies sacrées qui vivaient dans le temple de Junon, en se disant que ce ne serait pas un crime de les tuer pour les manger.

Mais les oies étaient sacrées aux Romains. Les tuer eût été un sacrilège.

Il arriva, une nuit, tandis qu'un jeune Romain, nommé Manlius, était endormi près de son épée non loin du temple de Junon, qu'un bruit étrange troubla ses rêves, l'éveilla subitement et lui fit saisir son épée en se levant rapidement.

Il reconnut le bruit aussitôt. C'était le cri des oies sacrées. Qu'est-ce qui avait réveillé ces oiseaux?

Le bruit augmenta, et devint bientôt une rumeur d'alarme et de panique; tout le troupeau d'oies remplissait la nuit de ses cris de frayeur.

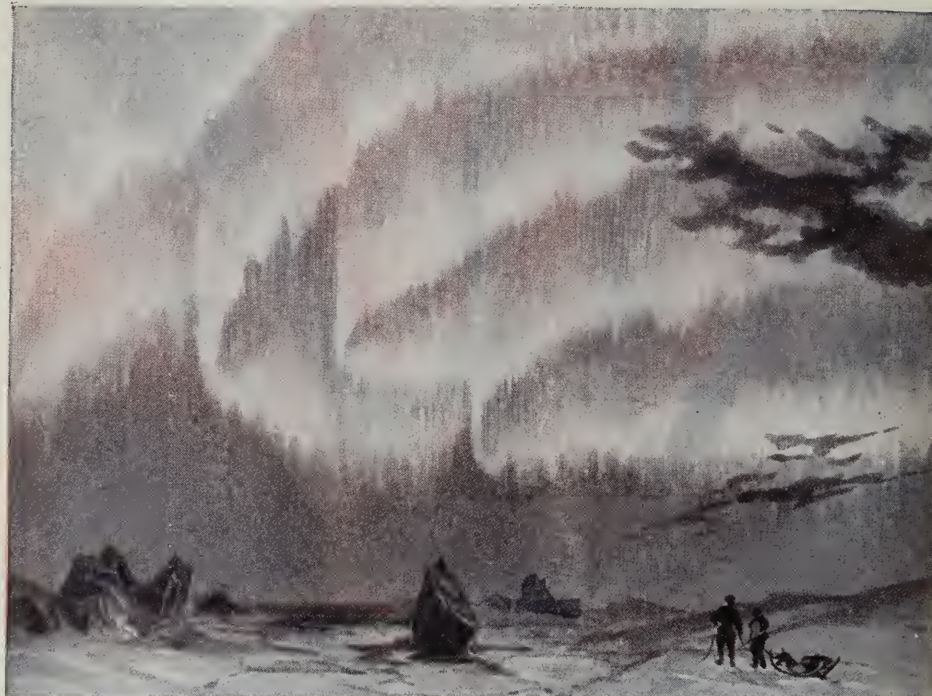
Manlius courut aux murs du fort et se pencha. Il se trouva en face d'un Gaulois!

Le chef des Gaulois avait conduit ses hommes à l'assaut pour une attaque nocturne et il allait se hisser par dessus le mur quand Manlius apparut. Manlius aussitôt saisit les poignets tendus du Gaulois, arracha ses doigts du parapet et lança son ennemi à bas de la colline.

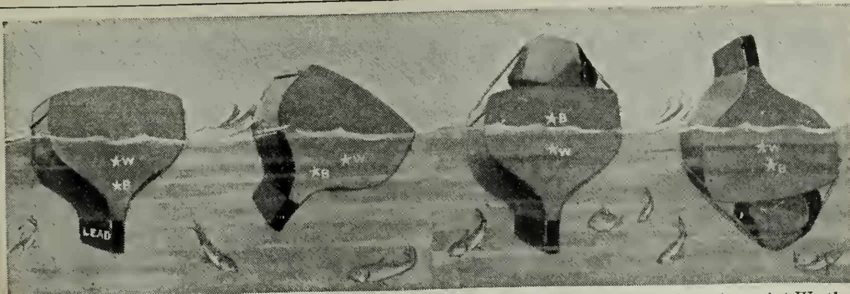
Le cri d'alarme des oies devint de plus en plus perçant. Les Romains furent éveillés en sursaut, et, saisissant leurs armes, ils se hâtèrent d'aller voir ce qui se passait. Ils trouvèrent Manlius qui défendait les murs. Avec un cri de victoire, ils s'élancèrent à son secours et en quelques minutes, toute la garnison fût éveillée; les Gaulois furent repoussés et complètement battus.

THE NEXT STORIES ARE ON PAGE 4049.

THE GLORY OF THE POLAR LIGHTS



During the long Arctic and Antarctic night when the sun is hidden for months, the gloom and darkness of these regions are lit up by brilliant displays of the Aurora Polaris, or polar lights. This exhibition of light and color, one of the most magnificent electrical displays in all Nature, takes various forms. The lights were called Aurora Borealis or northern lights until it was found that they appear also in the Antarctic regions.



A boat must be weighted at the bottom to lower its centre of gravity, B, below the point W, the centre of gravity of the water the boat displaces. The boat will then rock, but not capsize. If, by putting a weight on deck the centre of gravity rises to B, above W, then the boat easily capsizes.

THE PULL OF THE EARTH

CONTINUED FROM 3820

THERE is a term connected with gravity which we must understand, and which we shall find will throw light on what we have already learned about equilibrium; this is the term *centre of gravity.* In the case of any object there must be, as we can imagine, a point around which the whole of it could be balanced. The amount of matter in the body would be so disposed all round that point that if it were hung by a thread at that point it would stay at that position. It would balance perfectly around that point. It is as if all the matter of the body were really massed together at that point, which we call its centre of gravity. Probably, a better term would be *centre of mass.*

If we have a round ball made throughout of the same material, the centre of the ball will be its centre of gravity. Now, suppose we take a square board with the intention of finding its centre of gravity, assuming, of course, that the board is made of the same material and is of the same thickness throughout. We want to fix a single thread to the board at one point, so that the thread will support the board evenly. That point will, of course, be the centre of gravity.

Now, we all know what a diagonal is—the line joining opposite corners of such a board. If we draw the two diagonals, the point where they cross each other is the centre of gravity. That is all very well, but it is not quite so easy to find the centre of gravity of a body that has an irregular shape. Suppose, for instance, that, instead of a square board or a round one, we had one of a quite irregular shape, and wished to find the point at which we could support it so that it would lie evenly. Let us pick up the board, tie a string somewhere to its edge, and let it hang steady. If we draw a line straight down the board continuing the line of the string, the centre of gravity will be somewhere in that line. Now, it is a very interesting fact that we should be able to say this for certain, and we must try to understand why we can do so. When the board hangs steady from the string, there must be, as in any other case of equilibrium, a balance of forces.

These forces, of course, are the earth's gravity pulling downwards and the tension of the string pulling upwards. Now, as these two forces act equaly and oppositely, the centre of gravity must be somewhere in the line of them, just as if the whole substance of the board were at that point. If the centre of gravity were to one side of the line of the string, then we should have what is called a *couple* of forces. Gravity

and the pull of the string would be acting not in the same straight line, but oppositely, in parallel lines, and this couple would mean that the board was twisted until the centre of gravity *did* come to lie under the string. The only real way to understand this—which is perfectly simple—is to draw a diagram for ourselves as we read it. First, we can draw a diagram showing what really happens; then we can draw a diagram showing the board with the centre of gravity to one side of the line downwards from the string, and then we can see how the couple of forces is bound to rotate the board, or turn it around.

HOW WE MAY FIND THE CENTRE OF GRAVITY OF A BOARD OR A PLATE

Now, we laid down no condition as to the point from which the board was to be hung. No matter from where it is hung, what we say is true. Suppose, then, that we hang it up again from some second point, and then draw the line downwards from the string, the centre of gravity will be somewhere in that line, as we said before; but we know that it is also somewhere in the first line we drew. Now, there is only one point which is common to both lines, and that is the point where they cross each other. The centre of gravity of the board is there. If we have made our experiment precisely, and if we can attach a wire or a thread to the board exactly at that point, we shall find that the board will hang evenly around it on all sides. Of course, we can try the same experiment with a plate, or a slate, or any similar flat object.

If we take such a complicated thing as the human body, we certainly cannot easily find its centre of gravity. The body is very irregular in shape,and it is made of different parts of very various densities. Nevertheless, it has been possible by long study to find one deeply interesting fact. It is one of the most important facts of the whole body, because upon it depends the erect attitude, which means the freedom of the hands from purposes of walking, and the chance to make use of them for all the great human purposes.

THE GREAT JOINT THAT DIVIDES OUR BODY INTO TWO HALVES

If we look sideways at anyone walking, or if we look sideways at a skeleton, we can see that the hip-joints make the great joint which really divides the body into an upper half and a lower half. As we know very well, the trunk and head and arms can swing backwards and forwards upon the lower limbs at the hip-joint. Now, suppose a line were drawn straight down to the earth from the centre of the hip-joints of anyone who is standing. We have here a problem, as we can readily see, which is very like the problem of the board hung by a string. In this case the support is below instead of above, but that does not really matter.

Now, if we understand the principle of the centre of gravity, we can see for certain what must happen to the upper part of the body, as it is supported through the straight line down to the earth, from the hip to the heel. If the centre of gravity of the trunk and head lies so that the line dropped from it to the earth will lie in front of the line from the hip-joint to the earth, then the body must topple forwards. The centre of gravity of the upper part of the body is found in front of the line through the hip-joints in the case of all animals, like the horse and cat, and so on; and that, of course, is why they have to walk as they do. Only by muscular effort and a certain degree of skill can a horse or a dog walk on its hind legs.

WHY IT IS DIFFICULT FOR BABIES AND ANIMALS TO STAND UPRIGHT

Even of the man-like apes, including the wonderfully erect gibbons, which we may see any day at a zoo, it is true that the centre of gravity lies in front of the hip-joints. They can walk very well for a time, but it costs them labor, and they can scarcely stand. A very small baby is in exactly the same plight as these animals.

But as the baby grows the curve of its backbone changes in such a way that the center of gravity of the trunk now lies, as it does in all of us, behind the hip-joints. The two lines dropped to the earth, one from the hip-joints and the other from the centre of gravity, are parallel, and the forces acting through them make a couple, so that the trunk and head tend to rotate and roll backwards to the ground at the hip-joints, leaving the legs erect. That, however, is a thing which we never saw accomplished even by the most skilful acrobat.

It is prevented by the special development in our bodies of two huge bands of

fibres, one in front of each hip-joint, which prevent the trunk from rolling backwards under the influence of gravity. This beautiful arrangement means that, instead of standing upright only by muscular effort and careful balancing, we can do so in virtue of self-acting mechanical principles. Someone may say that all this is not the story of the earth; but the body is the child of earth, and the laws of the earth act in it and upon it, and the body is successful in so far as it obeys and is adapted to the laws of the earth.

WHEN A THING IS STEADY AND WHEN IT IS UNSTEADY

We have already studied the various kinds of equilibrium, and learned their names—stable, unstable, and neutral; but, of course, we ought to be able to define the exact causes which make the difference between the equilibrium that is stable, or steady, and those that are neutral and unstable. Our study of the centre of gravity can explain this. The simple law is that anything is in a state of stable equilibrium when the centre of gravity is raised by any disturbance, but it is in a state of unstable equilibrium if anything that disturbs it lowers the centre of gravity.

All this is quite plain if we think of the centre of gravity as the place where all the stuff of the body may be supposed to be collected. Now, if anything is going to raise that point, as, for instance, when we push against something hung from a string, then, when the force which raised it ceases to act, gravity, which is always acting, pulls the body back to where it was before. This is true of any case of stable equilibrium, such as that of the slightly tilted tumbler. But, of course, if the displacing force pulls down the centre of gravity, then, when it ceases to act, we cannot expect the body to return to its original position. There is nothing to make it do so; on the contrary, there is gravity to prevent it.

HOW AN EGG MAY ILLUSTRATE THE THREE KINDS OF EQUILIBRIUM

We can illustrate these cases, and also the case of neutral equilibrium, by an egg. For a second we may balance an egg on its point, but the tiniest disturbance will be fatal, because it means lowering the centre of gravity. This is a case of unstable equilibrium. On the other hand, we may have the egg resting on its side. Of course, we are assuming all the time that the yolk of the egg is unbroken and lies in the centre of the egg. Now we may roll the egg along the table by pushing it, just as we may roll a billiard-ball. In a little while, friction and the resistance of the air will stop it, and it will come to rest. The force we applied neither raised nor lowered the centre of gravity of the egg; its equilibrium was neutral.

But if, instead of rolling the egg by a push at one side, we try to tilt it at either end, we find that, after tossing up and down for a little, it will come back to its old position. So far as disturbances in that direction are concerned, it is in a state of stable equilibrium.

The reason is that when we tilted it we raised the centre of gravity, and when the finger was removed it returned to that position in which the centre of gravity is as low as possible. That, of course, must be the stable position—the position in which the egg as a whole is as near the centre of the earth as possible, so that the whole force of gravitation is on the side of resisting any disturbance of its equilibrium.

A COMMON ACCIDENT THAT HAPPENS WHEN MEN FORGET THE LAWS OF BALANCE

These questions of equilibrium and centre of gravity are of the gravest practical importance whenever the balancing of anything matters. Take, for instance, one of the most common and fatal of accidents, which happens somewhere or other almost every day in the year. We often hear that a row-boat has been upset and someone has been drowned. Except where the boat has been in a rough sea, it is safe to say that in every such case someone has been very foolish. There is a simple rule of safety which we all ought to know and act upon, or we may be responsible for the loss of one or more lives. The rule is that not more than one person at a time should stand up in a row-boat, and the lower even he crouches when he moves about the less danger there will be.

We see that this is a problem in equilibrium, and the whole question of equilibrium depends upon the centre of gravity. If the centre of gravity of the boat were in its keel, as in the case of those little toy bottles with half a bullet at their base, then the boat could not be so easily upset; it could be

tilted or turned upside down, but, at any rate, it would right itself at once. This is a case, of course, of stable equilibrium, where any disturbance means the raising of the centre of gravity. When we build what is called a lifeboat, we provide it, among other things, with a very heavy iron keel, which means that the centre of gravity is kept so low that, with the help of other arrangements, the boat, even when it is upset, has the power to right itself. But in an ordinary row-boat there is no heavy iron keel, and the greatest factors in determining where its centre of gravity lies are the bodies of the occupants.

WHY A ROW-BOAT CAPSIZES WHEN PEOPLE STAND UP IN IT

Directly we stand up, the centre of gravity of the boat is raised, and any disturbance is more likely to lower it, which means that the boat goes over. If two persons stand up together—especially if there is no one else in the boat—then the risk is very great indeed. The accidents that cause the loss of so many precious young lives every year are usually due to two persons standing up in a small row-boat, in defiance of the laws of equilibrium and centre of gravity.

It required a great deal of experiment and labor to discover how to make a boat which should have its centre of gravity so placed that practically nothing could upset it. The great English Lifeboat Institution has such a boat, and probably the most essential thing about it is the lowness of its centre of gravity. There are other qualities, such as the power of righting itself when upset. This makes the modern lifeboat perhaps the most wonderful vessel that man has yet put upon the water, small though it be.

All these questions apply, of course, to great ships as well as to small ones, and it is a matter of the utmost importance that the weight of a ship shall be rightly distributed. It would be very easy to build a ship so that, when a wave made it roll, its tendency would be to roll over still further and overturn.

HOW THE BALLAST OF A SHIP PREVENTS IT FROM TURNING UPSIDE DOWN

Many of us have been in a ship at some time or other, and we know that, when it rolls to one side because of a wave, it rolls back again. It may never have occurred to us why it does this. Now that we have learned Newton's first law of motion, we shall naturally ask this question. The wave started the ship moving in a certain direction; according to Newton's first law, the ship must go on moving in that direction until something stops it.

When we look into the matter, we find that the weight of the water which the ship has displaced acts upon the ship and tends to right it; but for this to happen—and no vessel could live in anything but the smoothest sea if it did not happen—the centre of gravity of the ship must be low down. We see to this by having the ship's hold filled with ballast, something dense and heavy, the result of which is to lower the centre of gravity of the whole ship.

If for any reason the ballast were taken and thrown out of the ship, the result would be the same as that of standing up in a row-boat. It means that the centre of gravity of the ship is raised, and this means that the equilibrium is less stable, and that it is much more liable to be overturned than it was before.

THE LIFE BOAT AND THE SUBMARINE, THAT ARE BASED ON THE LAWS OF EQUILIBRIUM

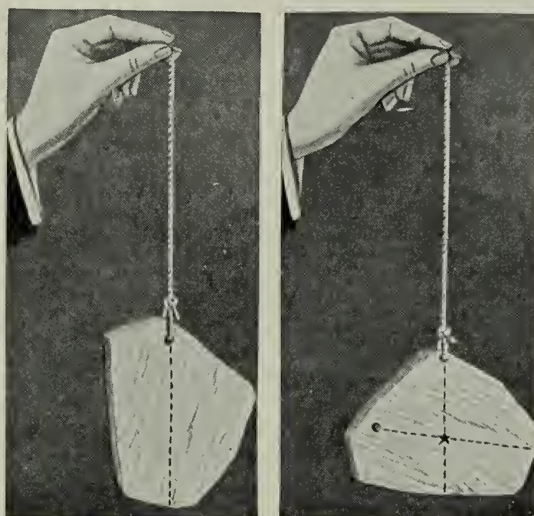
Long experience has enabled men who build ships to understand and master these principles in practice, so that, as we have seen, such a vessel as the modern lifeboat is scarcely capable of being improved upon. In recent years, however, men have been trying to make new things, the success of which depends upon the laws of equilibrium.

Submarine boats are an instance of this, and most of the difficulties have been mastered in this case; but it is the making of vessels to fly in the air that furnishes us with the greatest difficulties. The case of an ordinary balloon is quite simple, provided that the air be still. The ballast and the bodies of the passengers ensure that the centre of gravity shall be very low down, but even in such a case as this a violent wave of wind may upset the balance.

The problem becomes much more serious and difficult when we take the case of a flying machine, and it is a great mistake to suppose that anyone has yet accomplished the feat of making a flying machine whose equilibrium can be relied upon no matter what the wind is doing. This will be quite plain if we go back to our principles. They are very simple, but they apply everywhere. We know

that all motion depends upon forces; we know that all rest and all states of balance depend upon the relations between forces; and we know that there is a constant force of gravitation always acting, and always acting equally.

So long as we have only gravitation to reckon with, our problem is simple. Anyone can learn to make a boat that will float on still water, or a balloon that will stay right side up in still air, or even a toy flying bird that will do the same. The difficulty arises when we have to reckon with other forces which vary to any degree in their direction and in their strength. That is the problem for the machine that is to fly in the air no matter what the air is doing. The case is made specially difficult by the fact that, if the machine is to carry passengers, it must retain its right position always; it cannot be allowed to turn turtle, and then right itself. Probably no one can yet say whether this problem can really be solved.



These pictures show how we may find the centre of gravity of any flat object, such as a board. We suspend it from any part of its edge, and when it comes to rest draw a line in continuation of the line of string. Now we suspend the board from another point and draw a second line. The centre of gravity is situated exactly where the two lines cross.

A similar problem, but one that is not quite the same, has been perfectly solved by birds and by many insects. The bird is subject to all the laws which we have discussed; gravitation is constantly acting upon it; the pressure of the air downwards and of the air in motion, which we call wind, acts upon it also.

The bird has solved the problem of making power in itself that will keep it up even though the specific gravity of its body is greater than that of the air. Now that problem has been perfectly solved by man in modern flying machines. This is not to say that man has made or ever will make engines that have as much power in proportion to their weight as a bird's muscles have. But the difference is only one of degree. There yet remains the thing which the bird can do, and which we cannot do, and that is to fly and remain in almost any state of the air. Long and careful study has been made by many observers of the manner in which the bird balances itself. Photography has been called in for this purpose, and something has been learned by the kind of photography that is used for making moving pictures.

So far as we can learn at present, it seems that the success of the bird is a success which only life itself can achieve, at any rate, in such degree. However this may be, it is worth noting that the bird, like a lifeboat, can, in a sense, turn turtle and then right itself again. The bird recovers, and so does the lifeboat; but the case of the lifeboat, and still more of the flying machine, is very different from that of the bird, because these contain passengers, and they must be thrown out. It is as if we asked a bird to fly with a penny balanced on its back, and the conditions were not merely that the bird should fly no matter what the wind was, but also that it should not permit the penny to slip off. No bird could accomplish such a feat, but that is the feat which we ask the flying machine to accomplish. We are still very far from enabling the machine to do what the bird can do, but it is certainly worth our while to remember that we are also asking it to accomplish not merely what the bird does, but what even the bird cannot perform.

We must not leave the subject of gravitation without referring to what is, perhaps, the most important of all

the questions it raises—much more important than even the question of flying machines or the floating of boats. If it be true that here is a force which acts for ever, tending to pull every particle of matter in the universe towards every other particle, why does not all the matter in the universe collect into one great solid ball?

THE OLD IDEA THAT EVERYTHING MUST HAVE A BEGINNING AND AN ENDING

Now, there are two possible answers to the question, and it is necessary for both of them to be carefully considered and explained.

The first answer is now disputed by some thinkers, but we ought to know that it was once believed. It might be that this process of gathering together all the matter in the universe under the influence of gravitation was indeed going on, and had been going on since the universe was first made, but that there had not yet been time enough for it to result in gathering everything together into a solid ball, though there might be no doubt that such an event must eventually happen. This has in it the ideas of beginning and ending, which people have always been inclined to believe, and which, at first, most of us will think must be true.

Not very many years ago these ideas of beginning and ending were supposed to be strongly supported not only by the existence of the law of universal gravitation, but also by the behavior of heat and power in the universe. Men thought that the universe was like a machine which had been wound up and set running, but which in course of time must run down. One great thinker stood out against these notions and said they could not be true, and that was the famous English scientist, Herbert Spencer.

THE THEORY THAT A FAMOUS THINKE TAUGHT ABOUT THE UNIVERSE

Spencer declared that, though we could not name or discover them yet, there must be other forces in the world which acted in the opposite direction to those we knew, such as the force of gravitation, and that the history of things in general must be a rhythm, like a wave going on and on for ever, "from everlasting to everlasting," as the Bible says of God.

Now many have come to believe that Herbert Spencer was right, and that the answer to the great question of what must be the consequence of gravitation is not what people supposed. Of course, we do not need telling that if what we have asserted about gravitation be true, and if there be no other force opposing it, it *must* at last have the consequence of gathering together all the matter in the universe. But we are now beginning to know something of the wonderful forces, also always at work, which act in other directions.

For instance, men have lately proved to absolute certainty the existence of a force which is exerted by light, by radiant heat, and by other forms of radiation, which are known as *radiation pressure.* Everyone has heard of gravitation and very few people have heard of radiation pressure, but the one is just as important as the other.

A FORCE THAT ACTS AGAINST THE PULL OF GRAVITATION AND SCATTERS THINGS

This pressure acts in exactly the opposite direction to gravitation, and though, under the conditions we know best, gravitation is much the stronger and has its way, yet under other conditions, which are just as common in the universe taken as a whole, radiation pressure is stronger than gravitation, and has its way, with the result that the matter which is acted upon, instead of being gathered together into a solid ball, is scattered.

The discovery of radiation pressure is of great importance to science, but it is of far greater importance in another way, and that is why we must mention it here. Its highest importance is that it helps to give us new ideas of the universe itself. Without this discovery the law of gravitation was a great argument in favor of the old view which looked upon the universe as something which had been made and set running, and must eventually run down.

There is a great difference between this idea and the latter one, for which some now claim the support of science as well as of pure reason—that the universe has neither beginning nor ending, but is an eternal thing, the eternal revelation of the Eternal God, who sustains it "from everlasting to everlasting."

THE NEXT PART OF THIS IS ON PAGE 3977.

There is no more charming wild flower than the foxglove, a single plant of which produces over a million seeds. Were it not for birds and insects, foxgloves would soon overrun the whole country

HOW PLANTS TRAVEL

CONTINUED FROM 3816

WE already know some of the ways in which the parent plants send their seeds into the world, so that they may have a chance of finding fresh ground where they will thrive. But, in addition to the various interesting methods described on page 3809 of this book, there are other clever plans that plants have hit upon in order to make their way in the world.

Some of the weeds that now overrun our fields were not known here until recent years; and, on the other hand, some of our own weeds have managed to get taken to distant countries where they were unknown. Some of these weeds, too, when they reach a new country, flourish so well that, for a time at least, they become a greater nuisance than they have been in their own land.

Many European plants have traveled thousands of miles, even to far South Africa and Australia; and some of them have been met with on lonely islands in the South Seas. How do they get so far to these islands, where the sea is all around? They go in ships, just as we should go. Some of them are carried by birds, perhaps in easy stages, instead of going direct, and a few have been taken out by emigrants, who thought they would like to have some of their favorite wild flowers growing around their houses in the new country to remind them of the old home they have left. In this way, years ago, a Scotsman who was leaving his native land to settle in Australia took with him some seeds of the thistle and other plants. He sowed the seeds, and they came up so well in the new soil that his thistles were greatly admired, and every Scottish settler for many miles around went to see the familiar plant of the old country, and all begged for seeds. In a few years thistles had taken such a hold of that part of the country that the farmers ceased to admire them, and felt not at all inclined to bless the patriotism of the man who had first sown its seeds there.

In much the same way the water cress was taken to New Zealand. In Europe the watercress is never a nuisance, because it grows on the muddy margins of streams, or across the beds of shallow brooks. But in New Zealand it rapidly spread from the brooks and streams into the rivers, and grew so large and strong that it filled up the waterways and prevented boats from traveling on them. These plants were taken abroad with a purpose; but there are many that have

been taken by man without his knowledge. Years ago, before North America was so well peopled by white men as it is to-day, one of the European weeds, the plantain, found its way here. Nobody would want to take such a plant with him, for it has no showy flowers, and is not eaten by us. But its seeds came from Europe with the immigrants, and wherever they made their homes, on the prairies and in the backwoods, the plantain sprang up, and then the Indians gave it a name; they called it the "White Man's Foot."

HOW THE "WHITE MAN'S FOOT" WAS BROUGHT TO AMERICA

They merely jested when they thus hinted that it was the white man's foot on the earth that caused this plant to spring up. It is very likely that the first plantain that grew in North America really did spring up in that manner; but there was no magic in it. Probably some early settler, when preparing for the journey to his new home, packed up the heavy boots in which he had walked behind the plough at home, and did not put them on again until he reached the new land. Now, if we suppose that a little of the English earth was clinging to the soles of those boots, the mystery is solved. It is almost impossible to take up from a field as much of the surface soil as will cover a quarter without having in that soil a number of the seeds of some of our weeds.

Sir Joseph Hooker once related a little story that made this matter very clear. An exploring party, of which he was one, landed on a lonely island at the other side of the world. No one lived on this island, and the visitors thought that they were the first men that had ever set foot upon it. But soon they came upon some of the common English chickweed, and, using the patches of this plant as a guide, they came to a low mound which was covered by it.

A SPADE THAT CARRIED ENGLISH CHICKWEED ACROSS THE WORLD

The mound was a grave in which a British sailor, who had died at sea, had been buried by his mates. It is almost certain that the spade with which the grave was dug had already been used where chickweed grew, and a few of its seeds had clung to it, to be brushed off on this far-away island, where they germinated and grew. There are many stories of the way in which common weeds of one country have been carried to other countries where they were unknown before, and we must say something of the way in which plants make their way without the aid of man. Many of the winged seeds, and those that have parachutes or sails, are blown for long distances by the wind. The wind drops them, and they sprout and grow into plants which produce flowers and seeds. The second crop of seeds are blown farther in the same course, or in several directions, and year by year that plant is found farther and farther away from its old home.

The seeds of waterside plants are carried for miles by water—perhaps for hundreds of miles—before they are caught by the muddy bank. The cocoanut, that we know so well, is borne by the sea, securely wrapped in its great coat of fibres, from island to island in the Southern Seas. Scarcely has a coral island risen to a level with the surface of the sea before numbers of cocoa-nuts are washed upon it, and there they grow and soon cover the island with tall, graceful palms.

A CUPFUL OF MUD THAT CONTAINED FIVE HUNDRED DIFFERENT KINDS OF SEEDS

Hooked seeds cling to the fur of beasts and the feathers of birds, and are carried far away. Birds not only carry seeds, but also bits of waterweeds clinging to their feet; and many birds fly enormous distances when they migrate. Years ago Charles Darwin caught some birds of this kind and washed the mud off their feet, and from it he grew a large number of plants, the seeds of which were in the mud.

To show how easy it was for birds to pick up seeds when they hopped along the shores of muddy ponds—into which millions of seeds are washed in rainy weather—he took three tablespoonfuls of mud from a little pond and put it into a breakfast-cup. There were many seeds in it, and as they sprouted and got large enough for him to see what they were, he pulled each one up to allow room for others, and kept count of them. From that small quantity of mud he obtained no less than 537 plants of various kinds!

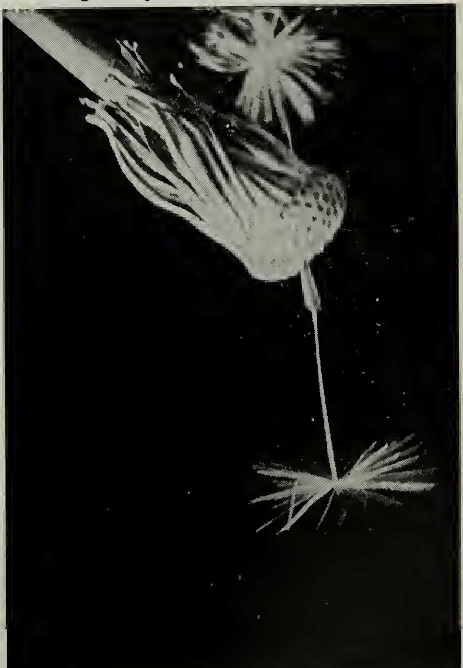
We cannot walk through a field or wood in summer or autumn without a

THE DANDELION'S LITTLE PARACHUTES

The dandelion, that we all know so well, was much used and appreciated by our forefathers for salads and as a medicine. Even now it is taken in the form of a drink by people who suffer from indigestion.

Here is the plant after it has gone to seed. The yellow petals have fallen off, and in their place there is a fluffy head, looking like a ball of down, that only needs a gentle puff of wind to carry it far away.

This fluffy head is made up of many seeds, to each of which is attached a number of tiny hairs, that spread out like a parachute, causing the seed, when it falls, to drop seed downwards.



Here is an old flower-head with a single seed magnified. The seed is pointed, and so is able to enter the soil when it falls. The parachute, catching every puff of wind, works the seed well into the ground.

large number of seeds clinging to our clothes, and though some of these will get knocked off again very soon, we shall find many still clinging to us when we reach home. Even in the case of those seeds that have been shaken off, the purpose of the plant has been served by their being carried some distance away, where they may find a more suitable soil and have more room to grow.

DIFFERENT KINDS OF PLANTS THAT GROW IN DIFFERENT KINDS OF PLACES

Nearly all plants have their special liking for certain places in which to grow, and the people who make a study of them—*botanists* they are called—know the exact kind of place in which to look for any plant they want. There is one set of plants we shall never find away from watersides or marshy ground. Others we must look for on peat-bogs. The field flowers differ from those we find in the woods, and these again are unlike those we get on the hillside or on the open downs.

The mountains, with their shallow soil and bare rocks, have their own plants, and many of them will not grow in the richer and deeper soils of the lowlands. Some of them go farther than this in their likes and dislikes; they must have a distinct kind of soil. For instance, this one will only grow upon soils of which chalk or lime forms part; that one will surely die if planted in soil that contains any lime. One must have a loose, sandy soil, while another prefers a stiff loam or clay, and so on.

Then they are particular about the amount of light they get, one insisting upon shade, another thriving only in full, hot sunshine. One likes to have the salt-laden sea-breezes blowing upon it; another cannot live anywhere near the sea. And thus it is that in the tropics we shall find a set of plants quite distinct from those in cold climates, or in the temperate region.

WHY SOME PLANTS WILL GROW ONLY IN HOTHOUSES

That is why, when plants are brought from India and South America to a temperate climate, we have to grow them in hothouses; and the plants from countries that are warm, but not so hot as the tropics, we protect in greenhouses, where they will be safe from any touch of frost. The plants that grow high up in the mountains we call Alpine plants, and for these in gardens we have to provide blocks of stone under which their roots will find coolness and moisture, that enables the leaves and flowers to stand the full glare of the sun.

A number of plants can only grow on the remains of other plants. An example of this kind will be found in the bird's nest orchid, which has no leaves, and is of one dingy yellow-brown color all over. Other plants fasten their roots to the roots of their neighbors, and rob them of the food these roots are getting from the soil. But these have green leaves, and work up the raw food they have stolen into leaf-stuff and flower-stuff. They are known as root parasites, and in this class come the cow-wheats, the eyebright, the red and yellow rattles, and the louse-wort, that grows in marshy places.

The mistletoe is only a partial parasite, for it has green leaves. Other plants, like the broom-rapes and the dodders, are wholly parasites, taking everything they require from their victims, and not putting forth a single leaf, or having a spot of green color about them. All these we shall have to talk about in their proper turn.

THE MOULD, WITHOUT WHICH PLANTS WOULD STARVE TO DEATH

We have already seen that all but the very tiniest of plants must have *mould* to grow in, and that this must be made by plants. If we were to dig up pure clay or sand from deep down in the earth and try to grow plants in it, we should find most of them would fail. They would be starved because, although they want this clay or sand, they want other things mixed with it.

Mould consists of such soil broken up and well mixed with the decaying leaves and stems of other plants. This makes it lighter and holds moisture and so enables the fine rootlets to work their way among it and feed upon it. The different amounts of this decaying matter is known as *humus*, and the different kinds suit it for plants of various tastes; for plants have likings just as animals have. The plants that thrive in a beech-wood will not live in a pine-wood, though the amount of light and moisture may be much about the same in both places.

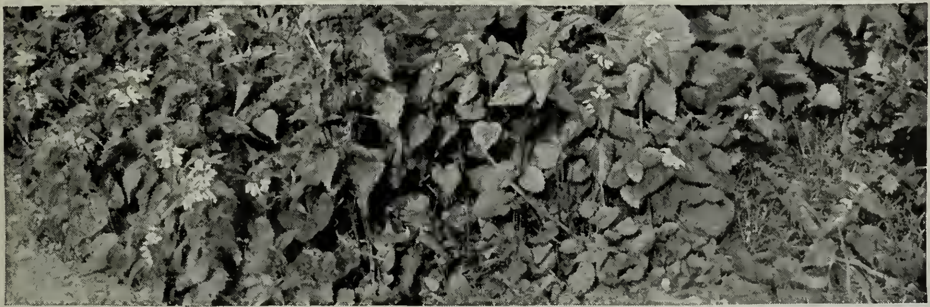
We have possibly noticed how large a number of seeds one plant will produce

PLANTS THAT IMITATE OTHER PLANTS

Some plants protect themselves by growing like other plants which have strong defensive powers. In the first picture brook-lime, on the left, saves itself from being eaten by imitating peppermint on its right. The right-hand picture shows the dead-nettle, which has imitated the poisonous stinging-nettle on its right.

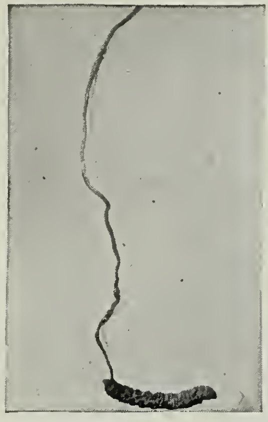
Plants in self-defence, imitate not only each other, but also their natural surroundings. In this flower-pot lie some examples of a South African plant which look like stones, and so cattle pass them over and do not eat them.

The objectionable stinging-nettle is not only a protection to the dead-nettle, but also to the horehound. On the left of the first picture we see the horehound growing beside and resembling its adopted guardian. The right-hand picture shows us an arum, which attracts insects by throwing out an odor like decaying meat.



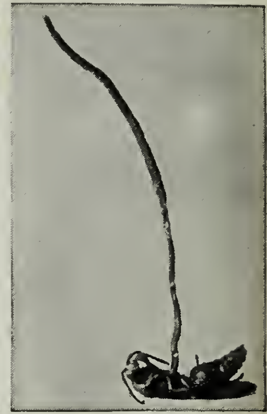
This is another picture of the stinging-nettle and the dead-nettle growing side by side. The stinging-nettles can be recognized by their flowers, although, when the dead-nettle blooms, its flowers are more attractive.

THE PLANT'S GREAT STRUGGLE FOR LIFE



This picture shows a curious New Zealand fungus growing out of the body of a caterpillar.

The fight for life is as keen in the vegetable as in the animal world. Here is a grass-blade that has forced its way through a hard root.



Here is a fungus like that on the left growing out of an insect which it has killed.

One of the best known of our climbing plants is the convolvulus, shown here. It will take hold of any other plant in order to lift itself into the sunlight.

The dodder not only climbs round other plants, as it is doing round the nettle, but attaches itself to its victim by means of circular discs, and feeds upon it.

The dodder is a strange plant, for it has no leaves, and this is why it is compelled to draw its nourishment from the plant upon which it grows. Here we see the dodder climbing up and strangling the heather.

Here we see part of the same dodder magnified. The flowers belong to the dodder, and not to the heather.

SEEDS THAT TRAVEL LONG DISTANCES

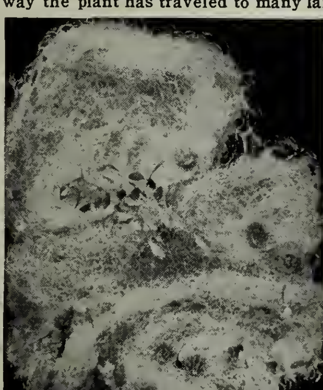
The seed-pod of the martynia, a tropical plant, has two hooks, that catch in the coats of animals. The pod is thus carried about, and the seeds are sown in new places.

An English plant, the common hedge avens, has a head of hooked seeds.

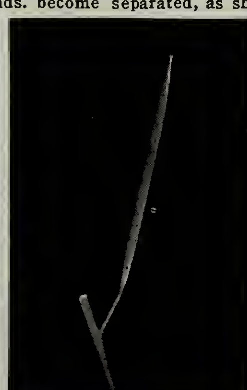
Here is an avens seed magnified, and it will be seen that it bears a resemblance to that of the martynia. The martynia is, however, much larger than the picture.

The seed of the Bathurst burr, shown here, gets into the wool of sheep, and in this way the plant has traveled to many lands.

The bulrush, which grows in marshes, is a plant that, when ripe, as seen in the upper part of this picture, has myriads of seeds. These become separated, as shown below, and the wind spreads them.



Here is sheep's wool, laden with various seeds. In Australia, the Bathurst burr, carried thus, has become a pest.



The willow herb has its seed contained in a kind of pod, that is shown in the picture.

When ripe, the willow herb's pod, seen in the last picture, bursts, and the seeds are blown long distances by the wind.

in a season. In all plants the number is very large; in many, such as the oak-tree, which drops thousands of acorns every autumn, it is enormous.

WHY PLANTS THAT SCATTER MILLIONS OF SEEDS DO NOT SPREAD OVER THE EARTH

A single poppy-head bears countless tiny seeds. One foxglove plant scatters one million and a half of seeds. Yet in the place where they grow, if we watch year by year, we shall find that the numbers of poppies and foxgloves are always much about the same. The wood will appear to have only as many oaks in it this year as it had ten or a hundred years ago, and the reason for this is quite plain.

Every plant has its enemies—slugs, insects, birds, and beasts—eating its seeds, killing its seedlings, or hurting the full-grown plants. The greater the dangers a plant has to face, the larger will be the number of seeds it has to produce to ensure that one of its children shall grow up to produce flowers and seeds in its turn, and so keep the race going. If in autumn we look in a wild garden where foxgloves have bloomed, we shall find the seedlings coming up thickly together.

Now, if we consider how large the leaves of the foxglove become before they send up their flowering stems, we shall see that there is not room for them all. What happens? They are not all as strong and healthy as each other, and so the strongest and best fitted to produce flowers starve and smother the sickly ones. That is one reason why the stem of the foxglove sways in the wind, and the mother plant tries to throw her seeds as far away as she can, to give all her children a chance of coming up. But still the sickly ones must suffer and eventually be starved to death. It seems very cruel, but it is only in that way that the fine vigor of the race can be kept up.

THE THOUSANDS OF LITTLE OAK-TREES THAT FAIL IN THE RACE OF LIFE

Of the many thousands of acorns that an oak will ripen in a good year, by far the greater number never have a chance to sprout. Deer, pigs, squirrels, and mice will eat them; so will the jay and other large birds. But still, if we go to the oak-woods in May or June, we can see that vast numbers of seedling oaks, a few inches high, have shot up, and are standing in crowds under the trees. Very few of them will be alive at the end of the year, for some of the many oak-eating insects will destroy them; rabbits will nibble them to the roots; and the only acorns that appear to have a chance of becoming trees are those that have been dropped by a jay or crow in the field or hedgerow, and just one here and there that has managed to fall in some spare corner of the wood. All this huge supply of acorns is to ensure that the race of oaks does not die out.

When a large oak-tree is cut down by a lumberman, or is struck down by lightning, it leaves a great clear space in the wood that used to be shaded by its long branches. In such a space thousands of seedling oaks will come up, and as they will here get more light and air than they would where the trees are close together, they will grow more quickly and strongly and a few will escape their enemies.

HOW THE OAKS OF THE FOREST WORK TO PRESERVE THEIR RACE

But the struggle will still go on between these little oaks, until the one strong tree will conquer the others, and fill up the space that the fallen tree once filled. To fill up that space, and to extend the wood on all sides, all the oak-trees in the wood produce their crops of acorns.

What has been said about the foxglove and the oak applies to all plants. Scarcely one attains to its full size without having fought hard for its life. Even if an acorn is dropped in the middle of a field by a jay, or gets there by some other means, it has in its early days to wage a battle for its life with the grasses, and if it succeeds in getting to the height of a few feet, it is then liable to be so injured by horses or cattle nibbling at it or trampling upon it that it dies.

Thousands of young trees spring up from winged seeds, far away from their parents, and struggle for years against browsing sheep and cattle, and never get higher than the grass. But if they happen to fall into a fence corner, and can grow up to the light, they may in the end win the fight, and, by shutting out light and air from the older bushes, kill those that attempted to kill them.

THE NEXT STORIES OF NATURE ARE ON PAGE 3943.

HOW TO SWIM AND DIVE

CONTINUED FROM 3786

SWIMMING is one of the healthiest and most enjoyable of sports. The ability to swim may enable any boy or girl to perform that greatest of all deeds—the saving of a human life. We can learn to swim almost as soon as we can walk; the babies of the South Sea Islands, indeed, are able to swim before they are strong enough to walk, and, out there, any native child who is not at home in the sea would be a curiosity.

It is quite possible for us to teach ourselves to swim, especially if we are confident, but we shall learn much more quickly if we have a friend or parent who can give us a helping hand. Water is quite able to support our weight, and we can easily prove how buoyant it is by standing with the water up to our waist and then trying to touch our toes. It is almost impossible to do this, because of the lifting power exerted by the water.

For our first attempt let us walk out into the sea or pool until the water reaches just above our waist. Turning towards the shore, we should ask a companion to put one hand under our chin and the other hand under our body. Thus supported, we must hold our head well back, close our mouth, and breathe only through our nostrils. It is, perhaps, best at first to work the arms only, so that we can fix our attention on them alone, letting our legs remain stretched out stiffly. Keeping our fingers and thumbs close together, and placing both hands just under the chin, we push our hands out as far as we can, thumbs touching, palms downwards, and the backs of the hands very slightly curved, just under the surface of the water. We then turn the palms outwards, and bring the arms round in a wide and strong sweep until they are in a straight line with the body. Next we bend the elbows, bring them to our sides, and place our hands in front of our chest ready for the next stroke. This movement is easily mastered, and we can now turn our attention to the leg-stroke. In order to do this accurately, we first gently draw both legs towards the trunk, the backs of the heels touching, and the knees and toes pointing outwards; the soles of the feet should be just covered by the water. We then kick both feet out strongly at an angle to the body, so that at the finish of the kick our legs are quite wide apart, and, without pausing, we bring both legs quickly together, being careful not to bend the knees. It is mainly this last movement that drives us along, and our companion will soon find it necessary to walk along beside us. We must not hurry in striking out with our hands and drawing up our legs, as these are negative movements. The legs should be drawn up as the arms are swept round, and kicked out as the arms are pushed forward. The breath should be taken in when the arms are wide apart. In kicking out, the best swimmers give the legs a kind of twist or screw as if working a paddle.

Should no friend be with us, we shall find that when we lean forward and push our arms out, our legs will rise towards the surface of the water.

We must next learn to swim on our backs. This is most important, as it is one of the ways by which drowning or unconscious persons are brought to land. It is, too, the least tiring method, and in long swims in deep water, if we turn and swim on our backs, it will enable us to rest our muscles and lungs. The stroke is very similar to the breast-stroke, only we lie on our back. A companion may assist us by placing his hand under the hollow of the back, but if we can swim easily on the breast we shall not need help. Stretching out our arms to right and left, we must lean back on the water and

lift our feet off the ground. Our legs will come readily to the surface if we keep our head well back with our ears under the water, and, if we lie quietly, we shall find that we do not sink. To move along, however, we bring our hands to our sides. Both arms are then brought out of the water in a circular sweep, and placed in the water as far behind our head as we can reach. The thumbs should touch in performing this movement, and the hands should turn so that as they enter the water the backs of them meet. The palms are then ready to present as large a propelling surface to the water as possible when the arms are brought in a wide and powerful circular sweep just under the surface, until they lie straight along each side of the body. The legs are brought up and kicked out just as for the breast-stroke. Should the arms be tired, they can be folded on the breast and the legs alone worked, the breath being taken during the finish of the kick-out.

THE SIDE-STROKE AND THE OVER-ARM STROKE

We now come to the side-stroke and the speedier overarm stroke. Turning on our right side, we push out our right arm in a straight line with the body, the fingers and thumb being closed and at right angles to the surface. The palm is then turned outwards and the arm is pulled down strongly, without the elbow being bent, until it points to the bottom. The arm is then drawn in to the body by bending the elbow and turning the wrist inwards, and moved along in front of the chest until it is in a position to push out again from just under the ear. The left, or upper, arm moves alternately in the same way, but the hand cannot go so deep, and the elbow must be bent slightly, otherwise the body would roll forward. The only difference in the movement of the arms in overarm swimming is that the left arm is brought right out of the water and dipped slightly farther in front of the head than the hand reaches when it is not taken out of the water. The breath should be taken when the head rises well out towards the finish of this stroke, and it can be expelled quite easily when the head of the swimmer is under the water while the arm is swung over.

There are at present two forms of leg-stroke used in swimming on the side. In the older method both legs were drawn up under the body and kicked out widely, as in the breast-stroke. In the newer method, now adopted by all the best swimmers, the knee of the upper leg is bent but little, that is to say that the left foot is never drawn up, but kicked slightly forwards. The heel of the under leg is brought back towards the body. Both legs are then brought sharply across each other as in walking, the left leg being straight as it passes the straightened right leg, and not being bent back until it has again crossed the right leg. We can, of course, swim on our left side if it is easier to do so, and it is as well to practise swimming on both sides.

The trudgen-stroke of the American Indians remains to be learned by any strong boy or girl who desires to move fast through the water. It is at first very tiring, and cannot be kept up for long by any but the very best swimmers. Each arm in turn performs a circle through air and water, the palms being turned away from the body as much as possible. The leg-stroke resembles that used in the side-stroke, but it is shorter and quicker.

Some swimmers give a kick for each stroke of the arm, but this is very tiring; and it is perhaps best to kick every time we make a stroke with our stronger arm, taking in breath when our head is well above the water.

HOW TO DIVE GRACEFULLY

Diving is a valuable and graceful accomplishment for the swimmer. If we see a person drowning, we can always go over the boat or pier feet first, but by arriving in the water head first and arms out we can more easily and quickly take our first stroke. We must learn to keep our feet together, and legs, body, head, and arms in one straight line, as we enter the water. Thumbs should be locked and the backs of the hands uppermost. We come to the surface of the water by raising our arms upwards. In standing on a diving-board, our toes should project over the edge, and the spring is taken from the balls of the feet. In diving at the start of a race, we must dive as far out as we can without falling flat, and rise to the surface without a moment's delay, drawing up our legs for our first kick as we do so. We should never dive into water of unknown depth, and our eyes should be opened under the water.

The most important diving, however, is the least showy, and it is the art of going to the bottom from the swimming position. By lowering the chin on the chest, rounding the back and swimming downwards with the arms, the legs are brought up and out of the water, and their weight then drives the body down, and by swimming with the head kept well forward the bottom can be reached.

TRICKS IN THE WATER

There are many tricks that can be learned, such as swimming like a dog or crab, swimming with arms and legs tied, swimming like a porpoise, the nautilus, and somersaults on the surface of the water, and some of these strokes are shown in the picture on page 3899.

It is sometimes necessary to remain stationary by treading water. We literally tread water as though walking upstairs, or we may perform the leg-stroke used in swimming on the breast while the body remains in an upright position.

There are certain things that we must not do in bathing. We should on no account enter water beyond our own depth until we can swim at least fifty yards without a rest. In learning do not depend on cork belts, bladders, or water-wings, as these prevent the body from taking its natural position in the water. They have been known to slip, and thus cause the wrong part of the body to float and the head to sink. We must not hurry our strokes in learning. It is quite surprising how slowly we can take our strokes and make good progress. We should never bathe within half an hour after a meal, or at any time when very hot, very cold, or very tired.

THE ART OF SWIMMING AND DIVING

The photographs on this page give the different positions used in diving and swimming, and also some of the fancy tricks which we can all learn. How graceful it is possible to look in diving from a height is shown in 1, where the body is in almost a straight line. Diving feet first from a height is shown in 2. Here the diver will go deeper than in diving head first. A Swedish dive is being taken in 3, and a high dive in 4, while the way to dive in at the start of a race is shown in 5. No time must be lost in coming to the surface in this dive. Three of the positions the swimmer assumes in the breast-stroke are shown in sequence in 17, 8, and 14. Swimming on the back is shown in 7, the trudgen, or Indian, stroke in 6, the side-stroke in 10, and paddling on the back to rest the arms in 11. Of the many fancy feats, we see, in 9, the torpedo float; in 16, the dead man's float; in 12, the nautilus; in 13, turning a somersault; and in 15, swimming like a crab.

A FLEET OF LITTLE BOATS

BIG boats and small boats, heavy boats and little fairy boats we can make from fruits, nuts, and treasures of the garden and wood. Nimble fingers will soon build our little fleet; and in a big tub or bath, filled with water, we can set the boats afloat.

First we will make a gondola out of a banana-skin, choosing a perfect fruit, well turned up and flat between the ends. We cut down along the middle of the flat part, and through the opening cut the pulp into sections, which can be drawn out on the point of a pen-knife, leaving the skin perfect. Then we curve a piece of thin card, insert it towards the pointed end, and put a match for a seat towards the stalk end. We may have to put a copper coin in the bottom of the boat to steady it in the water. The result is seen in picture 5.

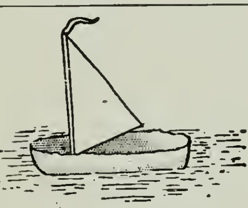
We can make another boat out of half a lemon or a small orange cut lengthwise. We remove the pulp, and trim the edges with scissors, insert strips of card for seats, and put the coracle-shaped boat in the oven to dry and harden. Little wooden dolls to represent ancient sailors, with pieces of wood for oars, can be seated in the coracle.

For a rowing-boat we can use the half of a very large pea-pod with the stalk cut away. Small strips of card will do for the seats, as we see in picture 6, and, if we are skilled in cutting out, we can shape little card rowers with two oars each, made of card or grass-blades.

We know, of course, that cocoanuts float. So out of the sawn half of one we can make a round punting tub, and in it place a small wooden doll, with a stick for a punting pole, as in picture 3.

All these things make fairly large boats; but there are many things from which we can make dainty little ones. There is, for instance, the half of a walnut-shell. We divide the walnut carefully with a knife, taking pains not to crack the shell, remove the nut, and scrape the inside of the shell clean. As this is suitable for a sailing-boat, we get a piece of stiff white paper, gum one side round a piece of match-stick, and with a little sealing wax secure the mast to the bottom of the boat. Picture 4 shows us what it is like. The walnut is easy to halve, but not so an egg shell; yet this makes a pretty white boat if we can manage to secure a sound half. Perhaps the best way is first to crack an egg in the middle and from that hole remove the shell in small pieces before carefully taking out the contents. It is better to leave an irregular edge to the shell, as in picture 1, than to risk cracking our boat.

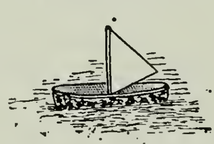
As to the sail for this boat, it can be made of thin white paper fastened to a mast of very stiff paper folded in halves, with one end bent at right angles, so that the bent part can be stuck down to the inside of the boat with sealing wax, while the edge of the sail is gummed into the folded paper that forms the mast. Being fragile, the egg-shell boat may easily be injured in a collision. As shipwrecks do sometimes occur, it is just as well to have a lifeboat or a raft on our miniature sea. A raft might be made of match sticks, or pieces of reed-grass roped together with coarse white cotton, as in picture 7. Small strips of



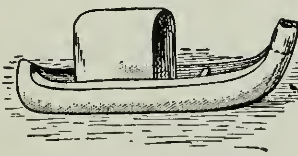
1. An egg-shell sailing boat.

2. A razor-shell canoe.

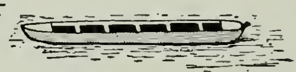
3. A cocoanut-shell punting tub.



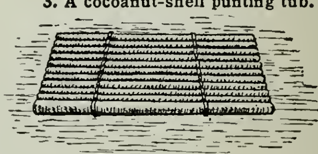
4. A walnut-shell boat.



5. A banana-skin gondola.



6. A pea-pod rowing-boat.



7. A reed-grass raft.

cork, cut lengthways from the corks of bottles, will answer the purpose of a raft, and refuse to sink. Failing any other material, the raft can be shaped from a large flat leaf, such as the plane or ivy.

During the acorn season we probably gathered some acorns with their cups; if so we have nice little punting tubs ready to be floated at once. An acorn in a cup can serve the purpose of a buoy, if we secure a thread to the stalk and a weight to the other end of the thread, which must, of course, be long enough to reach the botton of our sea. The acorn can be cut in halves lengthways, the nut removed, and the shell used for a small boat, the flat end forming the stern, and the pointed end the bow.

The petals of flowers float easily on water, so that from them alone we can get dainty small boats of many colors. Red, pink, yellow and white roses will give us variety. As a rose petal is very fragile, a sail, if we wish for one, would have to be made of tissue paper, say pink for a pink boat. To form the mast we can roll the paper down one

side. A drop of gum or paste will be all that is necessary to keep it in its proper position.

In autumn the halved outer coats of horse-chestnuts and walnuts make strong little boats. Then, if we get a large piece of cork or a small block of wood, we can shape it into a modern warship, and even use monkey-nuts, acorns, or filberts for torpedoes. A fireship is made from a lump of camphor set alight.

Some shells make admirable boats, and float well. The long-shaped razor-shell answers for a canoe, as in picture 2. Paper can be pasted over the two ends, and an uncovered space left in the middle. As such a boat is comparatively large, it can be launched near the gondola shaped from a banana. Mussel-shells also make good boats; and small, black, closed ones will suggest to us not only dangerous torpedoes, but porpoises floating on the surface of the water.

For all these things we must use our imagination and inventiveness; and we shall be surprised to find how interesting boat-making can be when we go to Nature's wonderful storehouse for materials wherewith to build them.

HOW TO KEEP FRUIT FRESH

UNFORTUNATELY for boys and girls, and for grown-ups too, fruit becomes ripe only in the autumn, so that at one season of the year we may have more fruit than we can eat with comfort to ourselves, and at other times, when we would like to have certain fruits, we cannot have them, either because the season of that fruit has passed or has not yet come. But in this age of great inventions and progress we are far more fortunate than our grandparents were, and even than our parents were when they were as old as we are now.

We get large supplies of fruit from California in the west, and Florida in the south, to say nothing of the great quantity of tropical and sub-tropical fruit shipped from the West Indies.

Thanks to the quickness with which railway trains and modern steamships can carry fruit, and to the modern methods of keeping fruit while it is being carried on the ocean, we have two seasons a year for many kinds of fruit. But, in spite of that, it is as well to know how to keep fruit longer than we can do by letting it lie about without any special measures being taken to prolong its life. So we shall learn how to do it in this article.

First, we must know what causes fruit to spoil. The decomposition of fruit, as we call it, is caused by the attacks of microbes, which are the very tiny little living things that we read something about on page 817. Once the microbes have begun to settle on fruit, it gets bad ever so much more quickly. Thus the effort to keep fruit fresh is really a fight between the microbes and ourselves. It seems ridiculous to talk about a fight between men and creatures so tiny that we can see them only with the help of a strong microscope. But, in spite of that, if we are not very careful the microbes will win the battle, and our fruit will spoil very soon. The microbes are bound to win eventually; we cannot help that. The most we can do is to beat them off for a time, to keep the fruit a few weeks or months longer than otherwise. We cannot make its freshness indefinite. If we know what conditions favor the growth of microbes, then we know that by avoiding or preventing these conditions we can make fruit remain fresh a little longer. Microbes thrive and multiply in damp and stagnant air; therefore our fruit should be kept in a place that is cool and shady, yet airy and dry. Fruit that is intended to be kept should be gathered when not fully ripe. Care should be taken not to break the skin, and any bruised fruit should be put aside to be eaten first. A dry, dark attic or cellar, with plenty of ventilation, makes a good place for keeping fruit. The fruit should not be heaped up. Each apple, pear, or other fruit should lie by itself, not touching its neighbor, and every few days each one should be examined, to see if it has begun to decay. If it has, it should be removed, so that it may not contaminate the rest. Wrapping each one in paper separately is a good plan, and if this is done the fruit need not be examined at such frequent intervals as when it is stored unwrapped. If these hints are followed, apples may be kept fresh for many months. Indeed, some fruits, such as winter pears, need to be kept for some time to get thoroughly ripe, as they do not ripen on the tree.

In America fruit-preserving has become quite a domestic art. The fruit is pared, cored, and put into glass jars, which are then filled with a hot, thin syrup, and firmly sealed. The syrup is made by dissolving sugar in water, and boiling it slowly for a few minutes after the sugar is dissolved. The solution must not be stirred after it has started to boil.

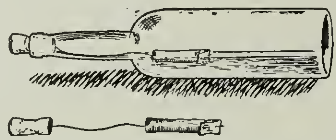
The spoiling of a can of peaches or other fruit is due to the development within it of great numbers of small forms of plant life, the germs of which are present in the fruit or the can before or during the process of canning. To prevent the fruit from spoiling, it is necessary to sterilize both the fruit and the jar. Sterilization consists in raising the temperature to such a point as will ensure that all the germs are killed. The fruit should be put into cans or jars as soon as possible after it is pared; otherwise the surfaces turn dark.

On board ship, in hotels, and elsewhere fruit is often kept in cold storage—that is to say, the temperature of the room or box in which the fruit is stored is kept down to a temperature of about 32 degrees Fahrenheit, which is freezing-point, by means of ice or refrigerating machinery. But this involves the use of expensive machinery or other apparatus, and is not suitable for an ordinary person who merely wishes to enjoy the lusciousness of fresh fruit a few weeks longer than he would otherwise be able to do.

A LITTLE TOY CANNON

THE idea of loading a cannon with a seidlitz powder seems funny. Of course, our cannon will not be a real cannon; it will be an ordinary pint or quart bottle. And we need not be afraid that we shall shoot ourselves or anybody else when we discharge it, for it is quite harmless.

First, we take a bottle and put sufficient water into it so that when it is turned on its side none of the water will run out. This means that the bottle will be about one-third full. Into the bottle we put the powder that we shall find in the blue paper of a seidlitz powder, and we shake the bottle so that the powder will dissolve properly. Now we take a piece of paper, and, by rolling it round a lead pencil, make a paper tube from two to three inches long. We close the tube at one end, either by plugging it with a cork, with another small piece of paper, or simply by folding the end over a little and fastening it with a small pin.



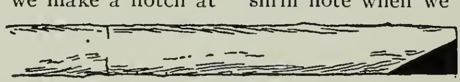
The seidlitz-powder cannon. The lower picture shows how the powder is fixed.

Then we take a cork that fits the bottle tightly, and, having tied a thread to the upper, or open, end of the paper tube, we fix the other end of the thread into the under side of the cork by using a pin. The thread should be of such a length that when the cork is put into the bottle, the tube will be about halfway down the bottle inside and just floating above the surface of the water in the bottle.

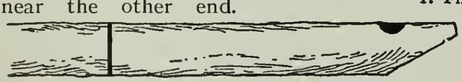
We now put into the paper tube the contents of the white paper in a seidlitz powder, and put the paper tube into the bottle, and then push the cork in tightly. All that we need to do now is to lay the bottle on its side on a table or chair. Presently our cannon will fire itself. As the water gets into the tube with its powder, it will fizz, and the force of this will send out the cork with a bang. The experiment is perfectly safe, but we must stand to the side and not in front of the bottle. It is well to perform this trick out of doors.

A WHISTLE THAT A BOY CAN MAKE

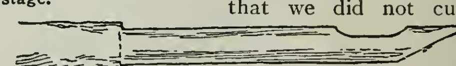
WHEN we are in the woods in springtime or early summer, we can make a good whistle easily and quickly. All we need is a knife and a thin piece of green sycamore or willow that we can cut from a bush or tree. The method of manufacture is simple. First we cut off the wood, selecting a piece with nice, smooth bark, and as nearly round as possible. It should be four or five inches long. Cut it straight across one end, and then at the same end cut a slanting piece off, as seen in picture 1. That makes the lip of the whistle. Now we make a notch at the top side of the lip, as seen in picture 2. We then cut a ring round the bark only, down near the other end.



1. First stage.

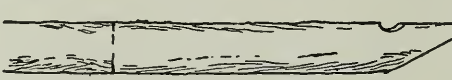


2. Second stage.



3. Third stage.

Now we take it and moisten the bark all round, either in a stream or pool, or in the mouth. Using the knife like a tiny hammer, we beat the bark all round and up and down with the handle of the knife, moistening the bark several times as we do so. We should beat it gently with the knife, and not hard enough to injure the bark. When we have done this we shall find that the bark can be slipped off in one piece right from the ring that we made to the point of the stick where the lip is. The surface of the stick, when we have removed the bark in this way, will be smooth, with a transparent and somewhat sticky fluid adhering to it. That fluid is the sap of the tree; and if it were not for this sap flowing up the tree under the bark as the tree grows it would die. We wipe off the sap, and then, with the knife, we enlarge the notch that we have made by cutting away a piece of the wood lower down, as seen in picture 3, which shows the piece we should cut away. Now we cut a very thin strip from off the top of the stick between the notch and the pointed end, or lip. Our whistle is now made. All we have to do is to replace the bark that we took off in one piece, as we see in picture 4. The whistle should now work perfectly, giving a clear, shrill note when we blow into it. If it does not quite work well, we may discover that the notch was not enlarged sufficiently, or that we did not cut away enough of the top of the mouthpiece. Let us remedy these defects if they exist, and see if the result is better. If we are entirely successful, we may become more ambitious, and try to make a whistle giving several notes on the scale, thereby making a musical instrument that can play simple tunes. For this larger instrument we need a little longer twig, say about nine inches long, and before loosening the bark we must cut several round holes that extend farther down the stick. Then, when we have removed the bark, we must extend the notch right down past all the finger-holes. We must handle the larger instrument when it is made very gently indeed, for it is easily broken.



4. The completed whistle.

A LITTLE VEGETABLE GARDEN

WHAT TO DO AT THE END OF JULY

WHEN we gather vegetables we ought to know the quantity that will be required, so that we do not take too many. Of course, the surplus can be used next day, but they will not be nearly so nice as they would be if they were freshly cut. In fact, when people say, as they often do, that home-grown vegetables are so much nicer than bought ones, it generally means just the difference that this absolute freshness implies. Even in lifting the early potatoes, only sufficient for the day should be dug up. Always dig up potatoes with a fork instead of a spade, as the spade will probably cut several of them in pieces.

The same rule applies to lettuces or radishes; never cut more than are required for the next meal. In the northern districts of the country a small sowing of cabbages may be made during the last day or two of the month, but in warmer districts the end of the first week in August is a better time for the work, as we do not want the plants to get too forward before the cold weather.

We must see that growing crops are well watered, and keep down the weeds. This is rather a slack time in the garden, so that any work that will keep us forward during a busier season may now be done. Thus, there are our pots and pans. These may have become green or otherwise soiled on the outsides; they should have a thorough scrubbing, and then be allowed to dry. Cleanliness in all gardening operations counts for much, and clean pots are especially desirable. We must never put soil into a wet pot. If we mean to take cuttings of geraniums in greater quantity than we have pots for, we may use boxes, and pot the plants later.

We may not have any potting to do at present, but we may consider here the proper way to pot a plant. We take, then, a clean, dry pot, and we put in the pieces of broken pots that are to form the drainage. Often the novice in gardening will make the mistake of not supplying sufficient drainage. We ought to put in two or three or four pieces, and more if the pot be a very large one. Then over the drainage we lay a morsel of moss, or quite old straw manure, so that the soil does not get down between the crocks and clog the drainage. On the top of this we put the soil—a portion of it first; then we arrange the plant so that it is quite in the centre of the pot, adding the rest of the soil, and pressing it firmly about the roots of the plant. But we must *not* fill the pot with soil level with the brim; we must leave half an inch or more, according to the size of the pot, so that, when we water, we may really pour the water *into* the pot, which we could not do if it were filled to the brim with soil. This is quite an important little matter.

Perhaps we have bought, or made, a small garden frame. Such a frame is very useful, especially during the winter, when it will give capital protection to young lettuce plants, the seed of which we shall soon be sowing. Now is the time to give a coat of paint to the frame, as this helps to preserve the woodwork from rain and weather.

To return to our flower garden for a moment, there is a piece of garden work that is often required, but which has not yet been described. Let us suppose we have a fine young rhododendron, of which we have tried to strike a cutting and failed. Let us try another method of procuring a young plant from it. We will *layer* a piece to see if we can induce it to root. We make a slanting cut in a branch that is near the ground, making the cut close under a joint, being careful not to cut the branch through; then we lay it along the ground and cover it firmly with extra soil, the branch still, of course, being unsevered. In due time roots will be formed, and, when thoroughly established, we may cut it free and transplant it. But, whereas the rhododendron requires a couple of years before severing, the carnation in our border can be layered at this very season, and by the beginning of October it will be ready to transplant; but then one is a hard, woody branch, the other a soft, juicy stem. The branch or stem being layered should be firmly pegged to the ground before being covered with soil: a hairpin is often used to peg carnation layers.

HOW TO SLEEP

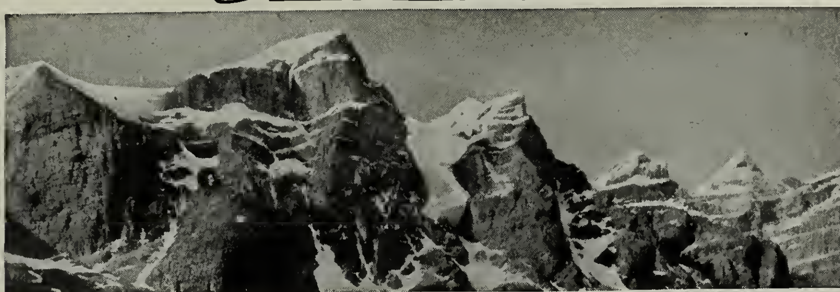
WE should all know how to sleep, for there are several rules which often make all the difference to the value of sleep, or to our getting any sleep at all. For instance, it is not good to sleep on the back. There are many reasons for this, but all we need know is that sleep on the back is more liable to be disturbed in various ways, including nightmare, than sleep on the side. The heart comes nearest the surface on the left side of the body, and also the stomach is mostly on that side, so most people find that they sleep best on the right side, and many people cannot sleep at all on the left side.' Another good rule for practically everybody is to go to bed to sleep, not to think or to read, and to get up in the morning when called. Always have plenty of ventilation in your bedroom. Open all the windows wide, and get all the outdoor air that you can even when sleeping. Have enough covering on your bed so that you will not take cold. Go to bed each night with pleasant thoughts on your mind, sleep in a room with plenty of good fresh air, and you will surely feel bright and rested when you awake next morning.

Sleep, you know, is a very good medicine. The energy expended during the day is renewed during the hours of sleep, and the tissues of the body, exhausted by work, are refreshed after a restful sleep. It is well to get all the sleep that you can. You have heard the old adage, "Early to bed and early to rise, makes a man healthy, wealthy, and wise."

THE NEXT THINGS TO MAKE AND TO DO ARE ON PAGE 3959

IN CANADA AMONG THE CLOUDS

The Canadian Rockies are rightly called the "Switzerland of America," and like Switzerland their wonderful glaciers and beautiful mountain lakes draw crowds of health and pleasure seekers every summer. There are fine hotels at Banff, at the Great Glacier, at Yoho Valley, at Lake Louise and many other interesting spots, where the people gather to enjoy the sports of fishing and boating and mountain climbing, such as can be found nowhere else save in Switzerland. In spring the slopes are covered with flowers.



WHAT MADE THE MOUNTAINS?

CONTINUED FROM 3781

I THINK we ought to say what made and what *makes* the mountains. This question is a very important and good one, but the way in which it is asked suggests just that greatest of all errors about the history of the earth. When we say "What made the mountains?" it sounds as if they had been made in a day, once for all, and that was the end of it. Mountains are being made and unmade to-day as they have been for ages past, and as they will be for ages to come. The forces that made and make them are the shrinking, and therefore wrinkling, of the earth's crust as it settles down upon the contracting interior.

If we look at the folds on the skin of a shrunken apple, we are undoubtedly learning something about the way in which mountains are made. But that is not nearly the whole answer. It may be that, to a greater extent than we have ever thought before, mountains are piled up and forced up from below in a way which is perhaps not so very different from the making of volcanoes. We can only say again at this stage that we are just beginning to guess what is the work done by radium in the rocks that make the earth's crust. We may be certain before long that radium is one of the makers of mountains.

WHY, WITH SNOW FALLING ON THEM, MOUNTAINS BECOME NO HIGHER

Plainly, something must happen to the snow which falls on such mountains, or they would be bound to grow higher, as this statement suggests. Anyone who raises such a thoughtful problem deserves to get a good answer, and it is a pity that so many similar thoughtful questions cannot yet be answered as well as this one can. As new snow falls on the old, the old is pressed from above, and it tends to slide by its own weight down the mountain.

In this way it is very tightly squeezed into ice, and though we think of snow as a light thing, yet a mountain-cap of ice, many feet thick, has, of course, a tremendous weight. As it slowly sinks down the mountain side, it makes a bed for itself, just as water does when it runs along the land; and so there is formed a river of ice which we call a glacier. The glacier may run into the sea and form icebergs, or it may melt when it gets low enough upon the mountain side. Some of the snow, but only a small amount, may form into avalanches, and so be disposed of. So we see that the snow that falls on a mountain shares in that endless circulation of water—from sky to earth and sea, and back to sky again—which is certainly going on everywhere.

HOW ARE VOLCANOES FORMED?

This is a question which has already been referred to more than once in this book, but it is also just one of those questions about which men are learning new things almost every year. We can be quite

certain that volcanoes are made by the heat inside the earth. The real questions are: Why does that heat behave as it does? and is that heat made in any special way when the volcanoes are formed? It is certain that, at its very beginning, a volcano is a hole that is broken in the surface of the earth's crust. Once that hole is made we can understand how the heat underneath goes on using it in future; things naturally find their way out through it, because it is the "path of least resistance," and so a pile of stuff is heaped up round it, and a volcano is made.

But the whole earth is hot. Why did the hole, in the first place, form just there? There are, I think, two answers. The first is that probably the earth's crust at these places is thinner or weaker, or made of material that can more easily be pierced; and, also, as we are just learning, possibly special sources of heat and power lie underneath it, owing to the presence of rocks or materials which contain more than their share of the wonderful element radium, or some other heat-producing element like it.

WHAT MAKES THE ROOTS OF TREES GROW IN THE GROUND?

The use of the roots of trees lies in the ground. They serve, first, to give the tree a firm hold, so that the wind shall not upset it. And they are the mouths of trees, as we might say, for a great deal of the food of the tree, which it cannot do without, is sucked up into it out of the ground by its roots. On the other hand, the roots contain no chlorophyll—the green stuff by which the leaves use the light—and so there is no need for them to be exposed.

All this is easy to find out and to understand, but it does not quite answer the question. We know why it is good for the tree that its root should grow into the ground and not into the air, but that does not tell us *how* the roots know in which direction to grow. Certainly gravitation helps them. It does this, not merely by pulling the roots into the earth—for roots strike sideways and very little straight downwards—but it helps by letting the roots know or feel where the earth is. Mr. Francis Darwin, the son of Charles Darwin, who showed how the countless kinds of living creatures have come upon the earth, has proved that plants seem to know where the earth is. They have a gravitation-sense, just as we have a light-sense or a sound-sense, and this helps to guide the roots to grow downwards. Also, the roots grow at their tips, where they get their food in the soil, and so they grow in many directions just where they find the food upon which they live. We can understand how the growing tip of anything will grow towards its food.

WHY IS IT THAT TREES GROW STRAIGHT?

If a wind blows steadily, or usually blows in one direction, it may bend a tree. Or if the tree grows near a wall, say, so that the light strikes it unequally on the two sides, it may grow crooked; but a tree usually grows straight because that is the best way for it to grow, and because everything helps it to do so. There is much less strain on its roots if it grows straight and its roots grow about equally in all directions through the ground, and so help to keep it in that position. Also, a tree throws out branches about equally on all sides, so that their weight all round the trunk helps to balance it and keep it straight.

Trees that are able to grow straight upwards are the likeliest to thrive, because growing straight means that there will be space for branches with their leaves on all sides, and so the tree can use more sunlight, and is better fed. There are thus, as a rule, many reasons why trees grow straight. Some of them, like those about the balance of the branches, are what we may call mechanical reasons, and others are deeper reasons depending on the way in which the tree lives, and the way in which, like every living creature, it tries to adapt itself to the conditions of its life, so as to live as well as possible.

WHY DO THE BRANCHES OF TREES GROW SIDEWAYS INSTEAD OF STRAIGHT?

Here, again, our best way of understanding why the living creature we call a tree behaves as it does is to find out the use to which it puts its branches. We find that they exist in order to bear the leaves by which the tree breathes, and by which it also feeds on the carbon dioxide of the air under the influence of the sunlight. It is the tree's business, then, to grow its branches in such a way that the leaves they bear shall be exposed to the sunlight as fully as possible, and

so that they may produce as many leaves as possible that can be useful. Therefore, the tree throws out its branches fairly equally on every side, and in growing sideways all round they are thus best arranged to expose to the sun's rays the leaves they bear.

DOES THE EARTH TRY TO DRAW THE BRANCHES OF TREES DOWNWARDS?

Of course, gravitation is all the while trying to pull the branches downwards, and in some trees the branches bend down a good deal, especially if the tree is old, and does not get enough good food from the soil. But the tree does its best to support its branches in their sideways position, which is best for their use, though it is, so to say, a "tiring" position to be held in. I mean that it needs much force of some kind to hold the branches this way.

If we try to hold our own arms out sideways, for ten minutes, we shall realise how great the pull of the earth on them is, and how inconvenient this position is. The tree's way of resisting gravitation is to form good, strong wood in its branches, and to make this wood grow directly out of the wood of the trunk; and in order to lighten the weight the wood has to hold up, it makes its leaves very light in weight. The lightness of the leaves is thus very important for the life of the tree.

IS SMELL A WAVE IN THE AIR?

This is a deeply thoughtful question. It is the people who ask questions of this kind that help the progress of knowledge, because they are questions that show that the person has been thinking. Questions at random are much less likely to be useful. Sound, as we know, is a wave in the air; and the heat we feel when we stand in front of the fire is a wave in the air; and light is a wave in the ether, passing through the air.

If, then, these waves explain seeing, and the feeling of heat, and hearing, why should they not also explain smell? But, in point of fact, smell is not a wave in the air. The great point about smell and taste, which go together, is that they are what are called *contact senses.* They are due to the actual *touching* of the tongue or part of the nose by particles of certain kinds. We cannot smell or taste at a distance. Of course, anyone will say that that is untrue about smell, but it is not. We seem to smell at a distance when we guess where the smell comes from; but, in fact, the tiny parts of the thing that has the smell have traveled through the air and have reached the smell-part of the nose. This is utterly different from the cases of the other senses. Smell would be like hearing if we smelled a grain of musk or an open bottle of perfume in a room because the musk or the perfume started special waves either in the air or in the ether. They do not; but portions of themselves are carried through the air to our noses.

DO WE SEE THINGS IN THE DISTANCE OR THE LIGHT THAT IS REFLECTED BY THEM?

It is now possible to answer this extremely interesting question. What we see is the light that is reflected by things or that has been made by them if they are luminous things, and we see it, of course, in our eyes; or, to be accurate, at the back of our heads, in the part of the brain where we really see. Yet we feel as if we see things where they really are. It is now proved that this is the result of practice and experience, and the knowledge which we have gained by walking about and touching things.

A baby, when it begins to see and use its eyes, has no idea of distance. Its very first impressions, we can be sure, are of something in itself; then, as it discovers its own body, and uses its fingers, it learns that the things it sees are outside itself. Yet even then, for a long time, the baby will reach out its hand to things that are as far away as the moon. But we have better proof still. Persons born blind, who have received their sight after they have grown up, tell us that when first they see, they get the idea of something that is felt inside their heads. Only with practice do they learn to do what we learned to do when we were small—that is, refer to the outer world the sensations which, indeed, happen inside our heads.

WHY DO SOLID METALS LET LIGHT THROUGH WHEN BEATEN THIN?

After all, it is quite natural that metals should behave as they do, nor are metals in the least degree peculiar in this respect. Light, we know, consists of waves in the ether, and the ether is everywhere. But where matter is present too, as, for instance, the matter of the air, or a sheet of glass, or a piece of

metal, or anything else, the passage of light is in some degree interfered with. The most perfectly transparent thing we know will yet stop some light. This is true, for instance, of glass; even the best glass used for the lenses of spectacles. It is true of the purest air, as we soon discover when we climb a high mountain, and find how bright the sunlight becomes when it has to pass through a thinner layer of air on its way to us. If matter has this effect on light, the thicker the layer of matter, the greater the effect will be; and this, of course, is true of metals, as it is true of every kind of matter. The only difference is that metals offer a particular resistance to the passage of light, and so, if they are to let light through, they must be beaten very thin indeed.

OF WHAT IS GRASS MADE?

Grass is a plant, or, rather, there are hundreds of plants which are all called grasses. What we call grass in the garden or in the fields is the leaves of this plant—green leaves which play exactly the same part in its life as the green leaves of an oak-tree play in the life of the oak. The oak and the grass, like a rose-bush, are both true flowering plants, and if we take a little trouble we can soon find the flowers of the grass for ourselves. Like other green plants, the grass is made by the power of sunlight out of certain materials in the air and in the earth.

The elements that we find in grass are the same as those that we find in all other living creatures without exception —carbon, oxygen, hydrogen, nitrogen, phosphorus, and a few more. But while we remember that these elements exist in the grass and make it, we must also remember that there is another thing there which is as real as real can be, though we cannot see or handle it. That thing is energy. Grass could not exist if it did not contain energy, which is really the transformed rays of sunlight. This is true of all green plants and of all animals, too. Our bodies actually contain, and could not exist without, some of the sunlight of the past which is stored up in them.

WHY DOES A ROPE NEVER LIE STRAIGHT WHEN THROWN ON THE GROUND?

If we can imagine a rope made of sand, and if we could throw such a rope on the ground, then it would lie straight. The trouble is that one cannot make a rope of sand. The making of a rope at all depends upon something which will always prevent us from throwing the rope so that it will lie straight when we have made it. We can only make a rope of anything that will hang together if there is some kind of pull between the atoms and molecules that make it. If there is no such pull together there cannot be a rope.

If we take a shovelful of sand and throw it out from us, it will fly out in quite straight lines; but when we throw out a rope we are throwing out something of which the molecules are wonderfully bound together in ways which are, at present, far beyond our understanding. Their pull on each other prevents the rope from flying out in a straight line. Perhaps this would not be so if it were possible to make a perfect rope, of which all the parts pulled equally and truly and evenly, and if we could throw this rope out in such a way as to give no bias, or favor, to any part of it—a thing quite impossible to do.

IF A FEATHER IS LIGHTER THAN AIR WHY DOES IT EVER SETTLE?

Nothing is more certain than that if a feather were really lighter than air, it would never settle. If a feather in time *does* fall to the ground, it must be heavier than air, whatever we may think at first. This is indeed the case. If we were to take all the matter composing a feather, and put it together again in a slightly different form—not the wonderful form that Nature has made it—then it would drop at once.

The business of the feather is to serve the life of a creature that flies, and therefore Nature has made it as light as possible. It is made of a texture that will itself hold air, and it is also spread out in such a way as to take the utmost possible advantage of the supporting power of the air. Yet, like many other things which the air will support for a time, the feather is heavier than the air, and therefore if the air is still, the feather must fall. It falls under the force of gravitation. If the air, however, is thrown into motion by the wind, its motion endows it with a force which may be greater than that of gravitation, and so the feather may be lifted from the ground into the air. Thus, it is all a question of the balance between one force and another.

IF WE WENT UP IN A BALLOON ABOVE THE AIR SHOULD WE BE ABLE TO HEAR?

Of course it would not be possible to go in a balloon above the air, because it is the air that supports the balloon which, without it, must instantly fall to the earth by gravitation, as we should fall if we tried to swim in an empty swimming-pool. But it is very interesting to ask whether a sound could be heard beyond the limits of the air. The answer is certainly not. Beyond the limits of the air there is only the ether, and though the ether carries light and heat it cannot carry sound, which is always made of waves in material things, like air or water or wood.

The English poet Tennyson has put into the mouth of one of the greatest of Latin poets some lines so perfectly beautiful that we should know them. The Latin poet, Lucretius, is supposed to be saying that the false gods that men believed in in his day lived in the spaces between one world and another, and could, therefore, know nothing of our sufferings and thoughts. They inhabit, he said,

The lucid interspace of world and world,
Where never creeps a cloud or moves a wind,
Nor ever falls the least white star of snow,
Nor ever lowest roll of thunder moans
Nor sound of human sorrow mounts to mar
Their sacred, everlasting calm.

WHY IS YAWNING INFECTIOUS?

Well, said the Wise Man, this is a question to which I think I have found the answer myself. I firmly believe the reason why yawning is so intensely infectious depends upon the nature of yawning. The first and most urgent necessity in the lives of all of us is to breathe. A yawn is a very deep breath. It depends, as a rule, upon the fact that from one cause or another—it may be that we are bored, or it may be that we have some illness—our breathing has fallen below what is needed, and the yawn is an attempt to make it up.

Now, it is a very well-known fact that one human being can affect another by what is called suggestion. A boy sees another boy eating a chocolate, and of course he wants a chocolate; one person sees another person afraid, and then he becomes afraid; if everyone around us is laughing and happy, we begin to laugh and feel happy; or if they are all in the dumps, we get in the dumps too. I believe that we can discover a great principle here. It is that suggestion is the more powerful the nearer the suggested thing is to the needs of life. That, for instance, is why the suggestion of fear is so powerful, as we see when a herd of animals take fright and stampede. And yawning is more powerfully conveyed by suggestion—infectious, as we say—than almost anything else we know of, because it happens to deal with the most urgent and constant need of all life, which is to breathe.

WHICH PEOPLE FIRST WROTE BOOKS?

Writing is so important for mankind as it preserves knowledge and enables it to gather like a snowball from generation to generation, that this question is one of the most interesting in the world. But it is very much less interesting if by "books" we mean something like our books—made of paper and bound to gether; or even if we include in the term writing on loose sheets of anything. The real question should cover all writing; whatever it was on matters very little. Writing on paper is at least as old as 2,000 years before Christ, and it was done by the Egyptians. They made the paper from the stems of a plant called the papyrus; and, of course, if sheets of this paper are bound together, that is a book.

Long before paper was invented, men wrote on other things, and one of the commonest was clay. This could be made into bricks or into cylinders, and these were written on, hardened, and kept. To-day thousands of these most ancient of books—as they really are—have been collected in museums. We may see them in many cities. They were used first, so far as we know, by the Babylonians and the Assyrians, even before the time of the Egyptian civilization; but it is quite likely that they are older still, and that the Babylonians learned how to write "books" on clay from earlier people, who were probably the ancestors of the Chinese.

WHY ARE BLIND PEOPLE SO QUICK AT HEARING?

The simplest answer to this question would be to say that blind people listen more attentively to the sounds around them; but it will be well to explain a little more than that. An ordinary person who has all the senses of sight,

smell, touch, hearing, and taste, receives a tremendous number of impressions from all sorts of sources, which are conveyed to his brain by special nerves and give him the ideas which he identifies with all those sensations. Now, if one of these nerves, or brain centres, should be destroyed or absent, the brain has fewer messages to attend to, and so has more time for the rest.

Thus in a blind person there are no means of his getting all the information which comes to an ordinary person through sight, so that if he wants to know how near he is approaching to somebody walking towards him, the only means he has of judging that is by listening to the sound of the footstep. He cannot see the distance which separates the two. In this way he becomes accustomed to listen deeply for all the sounds around him, many of which he would otherwise not hear at all; and so we find that blind people get into the way of doing so, and, as a result, are extremely quick at hearing.

HOW DOES AN EAR-TRUMPET HELP THE DEAF TO HEAR?

If we come to think of it, what we call the ear—that is to say, the outside part—is nothing more or less than an ear-trumpet itself, only the shape is a little different; that is, the external ear is a machine for collecting the waves of sound for the ear and conveying them into the internal ear, from which they pass in turn to the nerve of hearing and thence to the brain.

In people who are deaf it is possible by using a much larger collecting surface than the ear—that is to say, by having a bigger surface for the sound-waves to beat upon—to make the sound-waves reach the inside of the ear with greater intensity, and so stimulate the nerve of hearing. This is what the ear-trumpet does. In human beings the outer ears are not much used for collecting sound, but in some of the lower animals we can see them being used at any time; for example, in horses and dogs, which "prick up their ears," as we say, in order to catch the sound-waves. So that an ear-trumpet is just an artificial ear for collecting sounds.

WHY DOES IT NOT HURT WHEN WE CUT OUR HAIR?

We feel pain when we burn our fingers or suffer from any other kind of injury because almost every part of the body has innumerable small nerves in it, which carry to the brain the sensation of pain. It follows, therefore, that if there were no nerves there would be no pain; and, as a matter of fact, when a doctor wishes to do anything to a patient which would be very painful, he uses some means to deaden the endings of the nerves in the skin Now it so happens that our hair, like our nails, has no nerves, and therefore may be cut off without causing any pain at all.

WHY DOES HAIR GROW AFTER THE BODY HAS STOPPED GROWING?

Certain parts of the body are capable of growing into certain definite shapes and sizes and no farther, whereas other parts of the body have the capacity to keep on growing as long as the body itself is alive. Thus, a bone in the leg grows to a certain size and then stops, and nothing we can do to it can make it grow any larger. On the other hand, structures which are meant to protect the body, such as the skin and hair, are constantly being worn away, and are reproduced as quickly as they are lost.

WHY DOES SALT MELT SNOW?

We are all familiar with the instrument known as the thermometer, which was invented by a man named Fahrenheit, who lived from 1686 to 1736. He found that the lowest temperature he could obtain was got from a mixture of ice and salt, and in order to make a scale to measure heat he called the temperature of this mixture 0 degree, and the temperature of boiling water he called 212 degrees.

Now, on such a scale the freezing-point of water was 32 degrees, so that we say that it is freezing when the thermometer stands at 32 degrees Fahrenheit.

When salt is mixed with ice or snow in this way, the process of mixing changes the salt, ice, or snow into a liquid, but the temperature of that liquid is considerably lower than the temperature of freezing water or snow; so that we see one of the most striking effects of heat is its power of changing the physical condition of matter.

In this particular case it changes the salt, ice, or snow into liquid; but as that liquid requires a much colder temperature to freeze it than water does, the snow is slowly melted.

WHY DO THINGS GROW YELLOW WITH AGE?

This is a question of the production of a particular coloring matter, or pigment, in this case a yellow pigment. As a matter of fact, it is not everything that becomes yellow with age. For instance, an old quarter is not yellow, which points to the fact that whether the article becomes yellow or not depends upon what it is made of.

In the case of a leaf which turns yellow in the autumn, these coloring matters, or pigments, are produced by a chemical change, the green coloring matter splitting up after a long time into others, of which yellow is one. So most things which become yellow as they grow old are yellow because of the production of a yellow pigment from some of the substances contained in them, and these things will generally be found to be composed of vegetable matter.

WHY DOES WOOD WARP IN DAMP WEATHER?

As long as a piece of wood is growing in the tree, and is alive, it contains, of course, a certain amount of moisture, and this moisture is in the fibres, which we may think of as a number of small tubes packed side by side. Now, these fibres shrink or swell up according to the amount of moisture they contain. When the tree is cut down and made into timber, a great deal of the moisture is let out and evaporated, and if the wood is quite dry it will retain its shape as long as it is so.

It is one of the difficulties in drying wood to get both sides equally dry; and we may have noticed that if we place a piece of damp wood near the fire, or if we wet one side of a piece of dry wood and hold it near the fire, the wood immediately begins to curl, owing to the wet side contracting or expanding, while the other side remains stationary. The shrinking and swelling, according to the amount of moisture present, takes place only *across the grain* of the wood, leaving its length entirely unaffected by the moisture.

WHAT HAPPENS TO SNAILS WHEN THEY DIE, AS WE FIND ONLY THE EMPTY SHELLS?

We may sometimes find, while walking along the sea-shore when the tide is low, the white bones of a bird or some other animal. And, if so, we may ask why do we not find the dead bird, but only its bones? Perhaps we may say at once that it was because the bones of the bird were harder than the rest of it, and lasted after all the soft flesh and muscle and everything else had decayed and disappeared. So it is in the case of the snail. True, the snail has not a skeleton like a bird has, because the body of a snail is a very soft substance, like that of a slug. When the snail dies its soft body is easily broken up into many different chemical substances, and all the moisture in it evaporates, and all that is left is the hard shell, which will last a long time. So that the answer to the question is simply that the harder a thing is the longer it will last, no matter whether it happens to be the shell of a snail or the bones of another animal.

WHY DOES OIL FLOAT ON THE SURFACE OF WATER?

It seems very curious at first sight that one liquid should be able to float on the surface of another; but if we think carefully about it we see at once that whether a thing floats on the surface of water or not depends upon one or two things. First, it depends upon whether it is soluble—that is, will dissolve—in water or not.

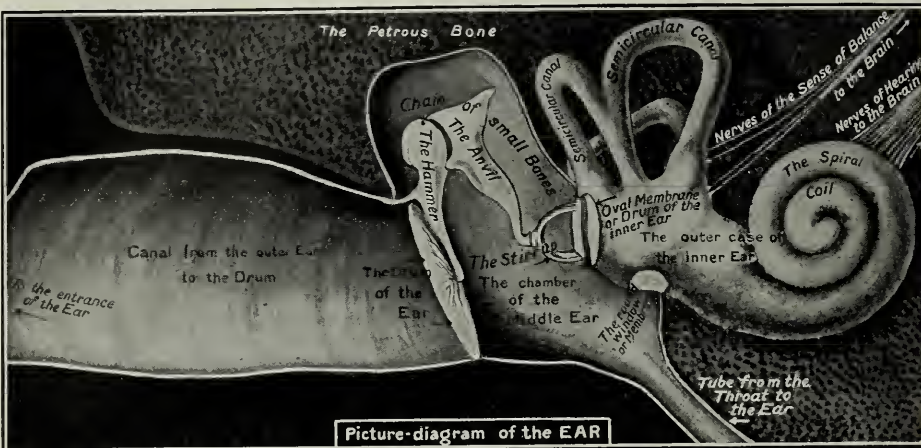
For instance, if we put a piece of salt in water it disappears, because the salt is soluble in the water. If, however, we put a piece of light wood on water it floats there, because it is not soluble, and therefore remains intact, and also because the weight of the piece of wood is less than an equal piece of water. It is much the same with oil. Oil and fat are quite insoluble in water, and as the oil is considerably lighter than the same bulk of water, it floats on the surface.

WHY DO SMALL THINGS FLOATING ON WATER MOVE TOWARDS LARGE THINGS?

The reason why small bodies floating on the surface of water are attracted to larger bodies is that, by the law of gravitation, any large body attracts in its own direction any smaller body, whether the two are floating in the water or whether they are in any other surroundings. Only if they happen to be in water it is easier for the power of attraction between the two to cause the smaller body to move towards the greater, because water is a mobile fluid and can be displaced easily by anything which moves through it.

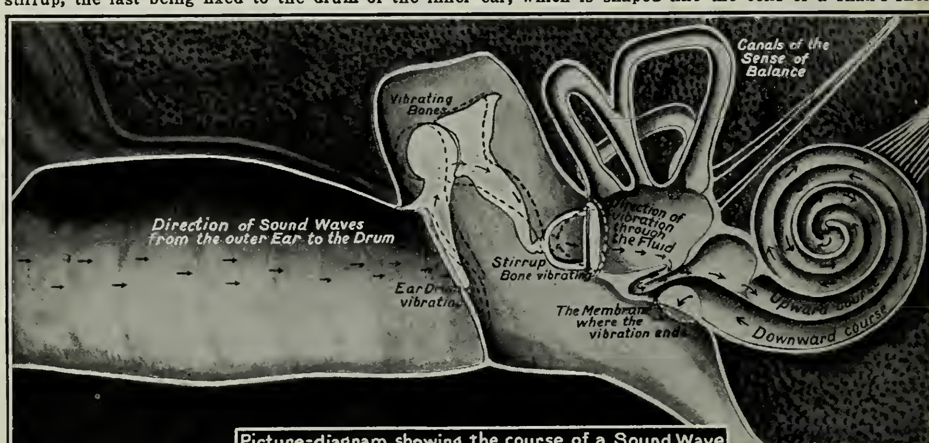
THE NEXT QUESTIONS ARE ON PAGE 4017.

THE WONDERFUL MACHINERY OF OUR EARS



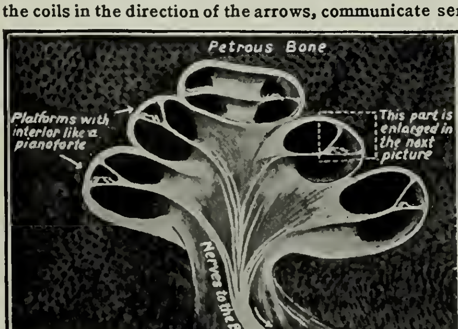
Picture-diagram of the EAR

This shows the inside of our ear, from the entrance to the end of the nerve that passes to the brain. The drum is stretched across the end of the canal, and on the other side is the chamber of the middle ear, filled with air that enters from the throat. In this chamber are three small bones, the hammer, anvil, and stirrup, the last being fixed to the drum of the inner ear, which is shaped like the coils of a snail's shell.

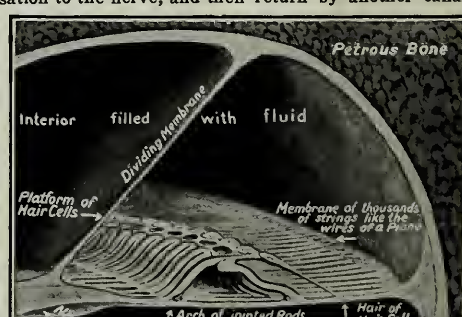


Picture-diagram showing the course of a Sound Wave

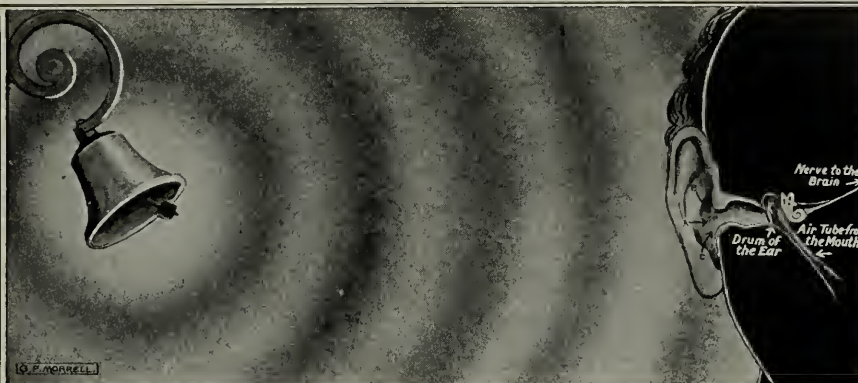
Here is a sound-wave striking the drum of the ear. The vibration moves the handle of the hammer, which pulls the anvil and pushes the stirrup, as shown by dotted lines, against the drum of the inner ear. Tiny waves of the fluid inside this inner ear pass through a membrane which lines the shell, and, traveling round the coils in the direction of the arrows, communicate sensation to the nerve, and then return by another canal.



In this picture the spiral coil is cut through from top to bottom. The galleries are filled with fluid, and contain very marvelous organs. The part in the dotted square is shown enlarged in the next picture.



Over 3,000 tiny hammers, jointed like those of a piano, support thousands of hair-cells that rest on a membrane. More than 10,000 strings are stretched across, like piano wires, and these oonvey the wave sensation to the nerve.



This diagram shows us how sound-waves travel in increasing circles and how the outer ear collects the waves, shown by the arrows A, B, C, directing them inwards so that they will strike the drum.

THE MARVEL OF HEARING

CONTINUED FROM 3822

WE know something of the brain and the spinal cord, which together are called the central nervous system, in the upper part of which the Self of man resides. But when we study the history of the central nervous system, we find that it has been developed from the surface of the body, and this fact in itself argues—as all the other known facts do—that its first business is to receive communications from the outside world.

At the present time these communications take very definite lines, which we call the senses. It is by the senses that we gain all our knowledge of outside things, and it is upon the delicacy of the senses that, in the first place, the high development of the human being depends.

We have reason to believe that this delicacy is, in the main, a matter of the brain itself, rather than of the channels from the world to the brain. But, in any case, it must be distinctly understood that this quality of sensitiveness is so invaluable that all the higher qualities of mankind are built upon it. It is, no doubt, possible to be unduly sensitive—sensitive to a degree that upsets the balance of the mind; but then, nearly every good thing can be exaggerated. We hear so much to-day of people being too sensitive that it is worth while to remind ourselves how valuable sensitiveness really is. John Ruskin long ago pointed out, by observation of men and women, what we can prove by examination of the body—that delicacy of the senses is the foundation on which are built all the highest and best developments of human character.

One of the most horrible consequences of what we at present call education, and of the dull routine through which so many of us are put, is that the beautiful delicacy of sense that enables children to respond to what is new, and to notice small differences between things, becomes spoiled; the edge is blunted, so that many people go through the world having lost, when they were children, the sense of appreciation of the things which make it such a beauti ul, wonderful, and interesting place. Some day, when we learn what human beings really are, we shall find better ways than those at present adopted in educating and dealing with children, and then we shall get better results.

And, now, having said so much, let us go on to study, one by one, our

senses, or highways of knowledge. It probably does not matter very much with which sense we begin, for the great principles are the same in every case; only we may begin by noting the names of the various senses, and especially by distinguishing—as people usually do not—between the senses which communicate with the outer world and certain other senses which do not.

THE SENSES BY WHICH WE KNOW THE OUTER WORLD

The senses which communicate with the outer world are—seeing, hearing, taste, smell and touch. But nowadays we have learned that it is not sufficient merely to say touch, for there are several senses in the skin besides mere touch. We must at least add the heat sense, the cold sense, and the pain sense to the sense of touch.

In addition to these senses which communicate directly with the outer world, there are other senses by which the brain is informed about the body. Of course, in a way, we may say that, so far as the brain itself is concerned, the body is part of its outer world. These senses come from the organs inside the body, from the muscles and joints, and from certain wonderful little canals in the inner ear, which we shall study later.

Now we can take the senses one by one, and we shall begin with hearing. We know that there is a special part of the brain concerned with hearing. If we were to use the word ear for the part of the body that really hears, we should certainly have to say that the real ear is in this part of the brain. The ordinary ear is on both sides of the brain, and the ear for music, as we say, is probably on the left side only in right-handed people, and on the right side only in left-handed people, though in great musicians the sensitive ear for music may perhaps be developed equally on both sides of the brain.

THE REAL EAR IN OUR BRAIN THAT CANNOT HEAR AT ALL

But we are quite certain that sound cannot be heard directly by this real ear in our brain. The part of the brain where we feel touch feels nothing if it is itself touched, and this is true of the senses generally. The brain only responds if the communication is made to it through the proper channel. So what we now have to study is the channel that leads from the outside to the hearing centre in the brain. Perhaps the best use of the word ear would be to describe the whole structure, from the surface of the body to the tiny nerve-cell where the hearing is actually done.

If we begin at the surface of the body, we find in ourselves and in most of the higher animals a pair of organs projecting from the head, which are the only parts of the organs of hearing that we can see, and which we therefore call the ears, though they are by far the least important part of the whole organ of hearing, especially in ourselves. We have all observed a dog prick up its ears, and so we learn that the real use of the ear—or, as we should properly say, the outer ear—is to catch waves of sound.

It is the general rule that the outer ear is provided with small muscles by which it can be moved in various directions. This serves two purposes. First, it enables the animal to make the most of the sound that comes to it, for the sound-waves are, to a certain extent, gathered up by the outer ear, and so are made more intense.

WHY ANIMALS PRICK UP THEIR EARS AT ANY SOUND

But the second great advantage of being able to move the outer ear is that it greatly helps to decide where a sound comes from. This is of great importance to such an animal as the antelope, which hears a sound and fears that it is the voice of a lion. We shall have opportunities of observing how animals prick up their ears, and we can imagine them saying to themselves: "Where-ever does that sound come from?"

It is very interesting to find in ourselves three little muscles attached to the outer ear, by which it ought to be pulled in various directions. These muscles exactly correspond with those that we find in the lower animals, but in ourselves they have quite fallen out of use. Though they are small, they are still quite capable of moving the ear; but we do not use them. A few people have the power of moving one or both outer ears at will, but there is no record of any human being who ever moved his outer ears when he was straining to hear a sound, or when he was trying to judge the direction of a sound.

We are able still to judge the direction of a sound, but we cannot do so any-

thing like so well as the lower animals, and the reason, no doubt, is that our outer ears no longer help us. Still, we are able in some degree to compare the intensity of a sound in the two ears, and so we judge more or less where it comes from. If the sound is made at a point equally distant from both ears, we are quite at a loss. A simple and amusing experiment or game will prove this.

AN AMUSING GAME THAT TEACHES US A LESSON IN SCIENCE

If someone is blindfolded, we can seat him in a chair and then make little noises, and ask him to judge where they come from. As long as they are on one side he will judge all right; but if we make the noises at the back of his neck, in the middle line of his body, or under his chin, he cannot tell the one from the other. Of course, we must not allow him to guess in other ways, as by the noise of our breathing or the warmth of our fingers; but we must ensure that it is a pure test of answering correctly the position of the sound. We shall then find that he cannot distinguish between a sound made at the back of his neck and a sound made under his chin.

If we try this experiment on one of those people who can move their ears, we shall find that he does not use his power for this purpose. But one of the lower animals could not possibly be deceived in such a case. By pricking its ears forwards and back, it would in a moment discover in which direction it heard the sound best. It would have no more difficulty in this case than when the sound was on one side. When the sound comes from the side, the animal judges, as we do, mainly by comparing the intensity of sound in the two ears.

THE CENTRES OF HEARING IN THE BRAIN THAT COMPARE NOTES

This seems very simple, and none of us has any difficulty in doing it; but it is wonderful, all the same, that the two hearing centres should be able to compare notes, so to speak, and when the left hearing centre hears loudest we should turn to the right, and when the right hearing centre hears loudest we should turn to the left. This is so because most of the nerve-fibres cross the middle line of the body on their way to the brain.

The outer ear is not entirely useless even in ourselves, for if it is all filled up except just at the opening of the canal that runs inwards, we hear less clearly. This experiment can easily be made. It shows us that to some extent the outer ear is still useful as a sort of ear-trumpet, though vastly inferior to that of most of the lower animals.

From the outer ear there leads a little channel, called the canal, along which the sound-waves pass. When we cleanse our ears, we cannot and do not wash this channel. It would be a very serious matter if we had to do so, for there would be grave risk of doing harm at its inner end. Yet, as a rule, the channel is kept perfectly clear and open, even though it is never washed. It is lined by tiny glands which produce a sort of wax, and as this wax passes outwards it carries impurities away with it. We think of this wax as a rather unpleasant thing; but, in reality, it is a beautiful means of cleanliness and protection. At its inner end the canal is closed entirely by a piece of thin, delicate membrane, which is exactly like a drum-head, and it is called the drum of the ear, or *tympanum*.

THE GREAT IMPORTANCE OF THE DRUM OF THE EAR

This drum is exceedingly important for the purposes of hearing, and it is a delicate thing. If it is injured, it is, as a rule, injured permanently, and the hearing is affected. It may be injured either from within or from without. Sometimes little children push beads or peas into their ears, and they may do much harm in that way. A child might have reason to regret for its whole life such a foolish action. When anything like a bead has been got into the ear, we should call in the doctor at once and not attempt to get it out ourselves.

This precious drum of the ear is also liable to be injured from within; and ear-ache in children, or indeed in anyone, should not be neglected, because it means, as a rule, more or less of a threat against the health of the ear-drum. We shall understand this better when we see what is on the inner side of this drum.

If we could see beyond the ear-drum, we should find that it made one of the walls of a little space, or chamber, hollowed out inside one of the bones of the head. This space is known as the middle ear. The bone in which it, and also the inner ear, lies is called the petrous bone, from the Greek word for a rock,

because it is the hardest bone in the whole body. This is interesting because a hard bone must undoubtedly conduct waves of sound very much better than a softer one.

THE LITTLE TUBE THAT RUNS FROM THE THROAT TO THE EAR

This middle ear is filled with air, and naturally we must ask where the air comes from; the answer is that it comes from the throat. There runs from the back of the throat on each side a little tube which goes to the middle ear and conveys air to it. If we shut the mouth and hold the nose, and then make a sharp movement as if we were sneezing, we can feel something happening in our ears. This is because when we made that movement we opened the little tubes, and drove some air along them into the middle ears. It is a very important thing for the safety and health of the ear, and also for the immediate purposes of hearing, that the air-pressure on both sides of the drum of the ear should be the same.

If the air-pressure were greater on the outside than the inside of it, the drum of the ear would be driven inwards and strained. If any disturbance in the throat or nose closes up these canals, so that air cannot get along them, this is liable to happen. It is said that when we go quickly down the shaft of a mine it is wise to make a swallowing movement a few times, because in swallowing we open the canals from the throat to the ear. The pressure of the outside air increases as we go down, and the drum of the ear is apt to be strained unless we open these little tubes and thus allow the air-pressure on both sides of the drum to remain the same.

WHY A COLD IN THE HEAD CAUSES DEAFNESS

Everyone knows that a cold in the head often causes deafness. The reason is that the cold, as we call it, spreads along the tubes that run to the ear. The lining of them becomes swelled up, and so they are closed, and cannot do their duty of keeping the air-pressure of the middle ear the same as the air-pressure outside. Hence the drum of the ear is strained and cannot vibrate as it should to sound-waves, and so we are deaf for the time. In more serious troubles of the nose and throat, such as may happen in scarlet fever, the middle ear may be invaded by the disease, and the drum of the ear may be broken through, and deafness for life is the result. It is probably quite fair to say that proper care and treatment from the first could prevent this very unfortunate result in every case.

But the most remarkable thing that we find in the middle ear is a little chain of three tiny bones, much the smallest bones in the body, which are there for a very special purpose. There is a picture of them on page 3912. They are called by Latin names, which mean the hammer, the anvil, and the stirrup, and the stirrup especially is exactly like its name. The handle of the hammer lies against the drum of the ear; the hammer is jointed to the anvil, and the anvil to the stirrup, and the foot of the stirrup lies against another sort of drum which leads to the most wonderful place of all —the inner ear.

HOW THE HAMMER, ANVIL, AND STIRRUP CARRY SOUNDS TO THE INNER EAR

The business of this chain of bones is to carry sound-waves across the middle ear. That is why it has to be filled with air, for otherwise they could not vibrate freely. Every time a sound-wave causes the drum of the ear to vibrate, it sets in motion the hammer bone which is fastened to it, and so the vibration goes on. If the joints between the bones become fixed, the hearing is spoiled in some degree. This may happen in old age.

Lastly, we find two muscles, very tiny but very useful, which pass into the middle ear. They have opposite uses, and we call them into action—though we know nothing about it—according to whether we want to hear a sound more acutely or less acutely. One of them is so arranged that when it pulls it tightens the drum of the ear. That makes the drum vibrate more energetically, and so we hear better. Whenever we strain to hear, we throw this little muscle into action. It is called by doctors the *tensor tympani*, which simply means the stretcher of the drum.

The other muscle has just the opposite effect. It is attached to the stirrup bone in such a way that when it pulls the bone cannot vibrate as well as usual. So when this muscle is in action it interferes with the conduction of sound to the inner ear, and when a noise is unpleasantly loud we throw this muscle into action. It is noticed that in certain

cases when there is anything the matter with the nerve that supplies this muscle, loud sounds become unusually painful.

That is all we need say about the middle ear. The more closely we study it, the more wonderful we find it, and we become almost inclined to think that there can be nothing quite so exquisite and perfect in the whole body until we come to study the inner ear, compared with which the middle ear is almost clumsy. The whole purpose of the chain of bones in the middle ear is to carry the sound-waves from the drum on its outer wall to a similar sort of membrane on its inner wall, on the inside of which is the inner ear. The inner ear is filled with fluid, and every sound that we hear reaches the nerve of hearing by conduction through fluid.

We think of sound as a wave in the air, and that is what it usually is; yet in its last stage, before reaching our nerves, every sound we hear is made of waves in water. This has a special interest if we trace the history of the ear and notice how it has slowly developed from its early stages in the fish, which hears sound-waves conveyed by water.

THE INNER EAR THAT IS FAR MORE WONDERFUL THAN THE OUTER EAR

The main part of the inner ear is a tiny and very delicate bony structure, shaped almost like a snail's shell. In the picture on page 3912 it is cut right through, and shows us how the canal is arranged in a spiral. We must understand that all this is filled with fluid. When the foot of the little stirrup bone is thrown into vibration by a sound, it vibrates the membrane to which it is attached, and so there is started a series of rapid little taps to the fluid which is lying against the inner side of that membrane, and the waves thus started run right along this spiral coil.

Now, when we carefully examine the inside of this coil with the aid of a microscope, we shall find that we have really come to the essential part of the machinery by which sounds are received. All the rest that we have studied is merely for conducting the sounds. The outer ear, the canal leading from it to the drum, the chain of bones, and the spiral canal filled with fluid, are only arrangements for conducting the sound in the best possible way to the ends of the nerve of hearing. We may compare all these parts of the ear with all the front parts of the eyeball, which we are going to study in a short time. These front parts simply serve to carry the light to the curtain at the back of the eye, where the nerve of vision begins or ends, whichever way we care to look at it. And the same is the case with the ear.

THE FIBRES OF THE INNER EAR THAT ARE LIKE PIANO WIRES

But we have not yet actually reached the ends of the nerves of hearing. The little nerve-fibres do not hang freely in the fluid of the spiral canal, for there is something in between. We find that along the whole length of the canal, stretched across it from side to side, there is a sort of platform made of delicate fibres. Their number runs into many tens of thousands. The canal becomes narrower as it reaches the top of the spiral, and so these fibres grow shorter.

If the spiral were arranged flat, in a straight line—which it doubtless would be but for the fact that a spiral takes up less room in the head—we should see that the fibres are very like a series of piano wires, or like those toy musical instruments made of strips of metal that are struck with little hammers. Many people suppose that there is a meaning in the resemblance of these fibres to a musical instrument.

We know cases where people have been perfectly deaf to one or two notes of the piano, but could hear all the notes above and all the notes below, and in some of these cases it has been found that the piano in the inner ear, so to speak, has been damaged in a way corresponding with the gap in the person's hearing.

THE LITTLE FINGERS OF THE EAR THAT RECEIVE THE WAVES OF SOUND

Now, upon the whole length of this series of fibres there are perched a number of small but wonderful cells, each of which has a few little things like short hairs sticking out from it, and these little fingers, or hairs, lie in the fluid of the spiral canal. Probably it is these tiny, hair-like fingers that receive the waves of the fluid, and then something happens in the cells. Lastly, if we examine carefully the lower part of each of these cells, we find that the nerve of hearing, which has come to this place from the brain, has sent a few tiny fibres

that end at the base of these cells. The fibres do not run into the cells, but the cells are, so to speak, perched upon the ends of the little nerve-fibres.

THE JOURNEY OF A SOUND FROM THE OUTSIDE WORLD TO THE BRAIN

Now we have actually traced the sound from the outer world to the ends of the nerve of hearing. We have seen the path of its conduction, sometimes along canals filled with air, sometimes along little bones, then along the canal of fluid, and, lastly, through their hairs into certain special cells made for the purpose. Here we come to a point which very few people understand, and as it applies equally to all the senses, we must know it thoroughly. We might suppose that the next thing to happen would be that the sound, having got so far, runs along the nerves of hearing to the brain. Nothing of the sort occurs.

Hitherto we have been dealing with things that are wonderful and complicated enough—so complicated that what has been said is only a mere outline of the facts—but at this point we have reached something compared with which all the rest is commonplace and simple.

The sound which reached the hair-cells of the inner ear does not pass along the nerves of hearing, but it sets up in them a nerve-current which runs to the brain. That nerve-current is not a sound-wave; it is utterly different in every way from a sound-wave. But it is that current, and that alone, which excites the hearing cells in the brain, and enables us to say that we hear.

If we examine the nerve of hearing through a powerful microscope, it looks just like any other nerve. But to say merely that it is capable of carrying a nerve-current which we translate into sound is not to state half the mystery, for we must consider the infinite variety of sounds that we can hear and distinguish.

THE MANY NERVE-CURRENTS THAT PASS TO THE BRAIN WHEN WE HEAR MUSIC

What must be the number and delicacy and variety of the nerve-currents passing along these nerves of hearing when a great musician conducts a big orchestra, and can hear every instrument separately, and know whether it be in tune or not! How delicate must be the varieties of current that are possible when we remember that it is scarcely possible for us to mistake the voice of one friend for that of another, and that, after twenty years, hearing a mere syllable pronounced will tell us that someone is present whom we have not seen for all that time!

So long as we confine ourselves to the study of the inner ear, and see the tens of thousands of fibres of different lengths, and the hundreds of thousands of hair-cells which it contains, we are not so much puzzled, because here is something which seems fitted to correspond with the powers of the sense of hearing.

There ought to be the power of noticing slight differences in sounds by means of an organ so complicated as the inner ear is. But the inner ear would not be of the least use without the nerve of hearing, and every one of these tiny differences in sounds means a tiny difference in the something that runs along the simple little white threads that serve to make up this nerve.

THE GREAT MARVEL OF NERVE-CURRENTS THAT VERY FEW PEOPLE THINK ABOUT

Language cannot say how wonderful these things appear to those who really think about them; and it is a great pity that so many of us should go through the world, hearing, seeing, and moving, and yet never giving a thought to these marvels upon which our lives depend.

The fact that nerve-currents, and not sound-currents, travel along the nerve of hearing is a general truth of all the senses. It is not light that travels along the nerve of vision. The place in the brain where we see is enveloped, and lives always in utter darkness; no light ever reaches it. What reaches it is the nerve-currents from the nerves of vision. All that the light does in entering our eyes is to do something which starts those nerve-currents in the ends of the nerve of vision.

And all that sound does in entering our ears is to start certain nerve-currents in the ends of the nerve of hearing. When we study the variety of sensations that are possible for us, we see that a nerve-current, though we talk about it so easily, must be nearly the most complicated and wonderful thing in the world, compared with which the waves of sound, or light, or electricity, must be considered quite simple.

THE NEXT PART OF THIS IS ON PAGE 3997.

WHAT THIS STORY TELLS YOU

A SPY in time of war is one who visits in disguise the territory held by the enemy for the purpose of gaining information about their plans. If he wears his uniform he is not a spy, and must be treated as a prisoner of war, but if he wears the uniform of the enemy or ordinary clothes, he is a spy and may be put to death by hanging. Soldiers think such a death disgraceful, and yet the love of their country has always led men to risk their lives to help their commanders gain necessary information, for it is considered fair to send out spies and every army uses them when needed. Here we tell of two brave men.

TWO SPIES OF THE REVOLUTION

CONTINUED FROM 3756

DURING the Revolution many spies were sent out by both sides, but two, one American and one English, have been remembered more than all the others. Both were young officers, well-educated, and lovable. Both risked their lives, were caught, and suffered disgraceful deaths while the British army held New York. Monuments have been erected to them both as you can see on another page.

NATHAN HALE, THE TEACHER AND SOLDIER

Nathan Hale was born in Coventry, Conn., June 6, 1755. Though a delicate child, he grew into a strong handsome boy whose smile made many friends. When less than sixteen years of age he entered Yale College and was graduated with honor in 1773, though only eighteen years old. For two years afterward, he was a successful teacher, but when the Revolution began he left his books, joined the army at Boston and was soon made a captain.

When Washington led the army to New York, young Hale went, of course, but we do not know much about what he did until after the American army was defeated at the battle of Long Island. Washington then retreated to the northern part of Manhattan Island. He did not know whether the British were preparing to attack him or to surround him, and called for a volunteer to enter the British camp.

Captain Hale offered to go, though his friends tried to prevent him. His answer was, "I wish to be useful; and every kind of service necessary for the public good becomes honorable by being necessary." He went to Norwalk, in Connecticut, on September 14, 1776, and crossed over to Long Island. Disguised as a traveling schoolmaster seeking employment he visited the British camps in Brooklyn and New York and gained much information which would have been valuable to Washington.

HOW AN ACCIDENTAL MEETING LED TO CAPTURE

No one seemed to suspect him and in a few days he returned to the point on the Long Island shore where he had landed. He had given orders that a boat was to meet him there on the morning of September 21st in order to take him back to Norwalk. The night before he spent at a tavern near by, and there he was recognized by a man, who informed the British soldiers who he was. Some say that this man was his cousin, who was a Tory, but it cannot be proved.

Early the next morning he went out to meet the boat which was to take him back. A boat came, but it was a British boat, and took him to a British ship. There he was searched and notes and plans of the camps were found in his shoes. He did not deny who he was or what he had been doing, when taken before General Howe. Though the British general is said to have been much pleased with the be-

havior of the young officer, the case was plain and he was sentenced to be hanged the next morning.

The officer in charge of the execution is said to have been brutal and cruel. We are told that he refused to send for a clergyman, or to allow the young man a Bible, and that he tore up the letters Hale had written to his mother, his sisters and the young woman he was to marry. When all was ready, the young hero bravely faced death, saying, "I only regret that I have but one life to lose for my country."

A beautiful statue of the young patriot by Frederick MacMonnies stands now in City Hall Park and some think is near the spot where he gave his life for his country. Others think he was executed nearer the East River and further north.

A YOUNG ENGLISHMAN WHO LOST HIS LIFE

Now let us turn to the Englishman who also risked his life and lost it. John André, the son of a Swiss merchant of London, was born in 1751 and was educated at Geneva, in Switzerland. On his father's death he carried on the business for a time, but after a disappointment in love, entered the British army, and in 1774 came to Canada to join his regiment. He was captured in 1775 and kept a prisoner for a year. When set free he was promoted to captain, and during 1778 was with General Howe in Philadelphia.

Under General Sir Henry Clinton, he was promoted to major, and made adjutant-general. During 1779 he was with the British forces in New York, where he won all hearts by his manners and his talents.

HE MEETS A TRAITOR TO THE AMERICAN CAUSE

Meanwhile General Benedict Arnold of the American army had been placed in command of the fort at West Point. General Arnold had been badly treated by Congress. He had enemies who had delayed his promotion and attempted to ruin him. While in command at Philadelphia he had married the daughter of a wealthy Loyalist and had gone deeply into debt. Somehow, at some time, the idea of betraying his country came into his mind, and this fact was made known to the British commander.

On September 20, 1780, by order of General Clinton, André went up the Hudson in the Vulture to meet Arnold. He went ashore, wearing his uniform, and the meeting was held in the woods. The arrangements were not ended when morning came, and they rode to the house of a farmer near by.

It was arranged that Sir Henry Clinton should ascend the river and attack West Point. After pretending to resist, Arnold was to surrender the fort, and it was hoped also to capture Washington, who was then in Connecticut. For his treason Arnold was to be made a British brigadier-general and receive $50,000 in gold.

ANDRÉ IS CAPTURED WHILE RETURNING TO NEW YORK

The Vulture dropped down stream, and the farmer was unwilling to take André back. He was, therefore, forced to try to reach New York by land. Wearing an old coat given him by the farmer, he set out on horseback. He passed beyond the American lines into what was known as the "neutral ground" because both parties claimed it, though neither was able to hold. it. On the morning of Friday, September 23d, a party of young Americans stopped him. André, thinking they were Tories, told them he was a British officer. After this they would not let him go, though he had a pass signed by Arnold. They searched him and found papers in his stockings which showed him to be a spy, and took him to an American officer, who, not believing that Arnold was a traitor, sent André to him.

THE TRAITOR ESCAPES, BUT THE SPY IS HELD

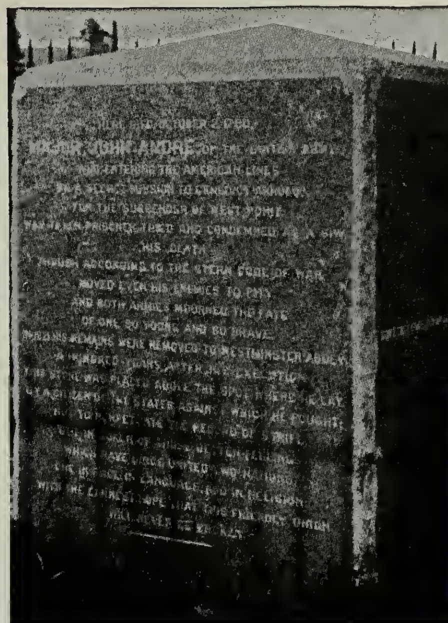
Before he reached West Point, the officer became suspicious and had him brought back, but a soldier went on to inform Arnold of the capture of the man who, it was thought, had forged his name. Arnold hastily escaped to the Vulture, and reached New York in safety.

When Washington arrived, a military court was assembled, and, after hearing the evidence, condemned the unfortunate young officer to death as a spy, though all regretted to make such a decision. Sir Henry Clinton tried in vain to save his life. On the morning of October 2, 1780, the brave young man was hanged at Tappan, though he begged that he might be shot instead. In 1821 his body was removed to Westminster Abbey and a monument to his memory erected.

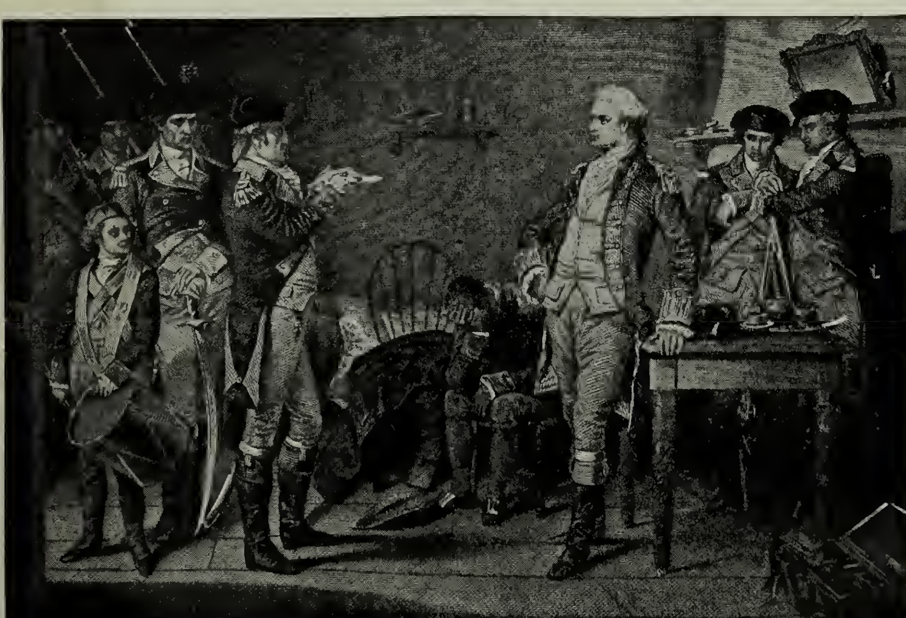
THE NEXT STORY OF THE UNITED STATES IS ON PAGE 4165

TWO SPIES WHOM ALL ADMIRED

This beautiful statute of Nathan Hale by Frederick MacMonnies stands in City Hall Park in New York City. The brave young officer was hanged as a spy, in New York, September 22, 1776.



This monument in memory of Major John Andre stands on the spot where he died October 2, 1780. It was erected by an American admirer. If your eyes are keen perhaps you can read the inscription.



The American officers who condemned Major Andre to death did so with great regret, for his bravery and dignity won the hearts of all, even those of his enemies. Here we see him as his death warrant is being read to him. He begged he might be shot instead of hanged, but his request could not properly be granted.

Two upper pictures copyrighted by Keystone View Company.

A PLACE WHERE MAN HAS NEVER BEEN

This is how a mountain over five miles high appears when you stand fifty miles away. It is Mount Kinchinjunga, 28,156 feet high, in the Himalayas, photographed from Darjeeling. The highest peak in the world, Mount Everest, which is 29,002 feet, does not look so high because great mountains surround it. No one has ever been to the top of either peak, for the air is difficult to breathe. In 1900 travelers climbed 21,000 feet up Kinchinjunga, but in South America men have reached the top of Aconcagua, 23,393 feet high.

From a photograph by E. G. Ponting.